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REPERTORY

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MONTHLY INTELLIGENCE

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AND

NOTICES OF ALL PATENTS GRANTED FOR INVENTIONS.

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THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CIX. SECOND SERIES. June 1811.

Specification of the Patent granted to RALPH WEDGWOOD, *of Oxford-street, in the County of Middlesex, Gentleman; for a new Character for Language, Numbers, and Music, and the Method of applying the same.*

Dated July 18, 1810.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Ralph Wedgwood do hereby declare that the nature of my said invention, and the methods of applying, and in what manner the same is performed, are as follows: The archetype of the character may be any regular figure, as a square, round, oval, triangle, or parallelogram, or it may be a combination of two or more such figures: but as the various parts of one figure only are in this mode of applying them more than adequate to the requirements of language, numbers, and music, and present a superior consistency, besides many other advantages, so I prefer one figure to a mixture of figures.

[redacted]

figures. I also prefer a square to other figures. The different parts of this square figure are made to signify all the various letters of the alphabet, figures, notes, and points. This I perform in printing by making three types, one of which will make a line equal to the whole side of the square figure, another making a line equal to one half of the side of the square, and which type I distinguish by adding a point thus |—· and another which makes a line equal to half the length of the side of the said square. For the particular shape of these three types, see the drawings hereunto annexed, Fig. 1, (Plate I.) To multiply the power of each type I cause both ends of them to make a similar figure, distinguishing the one end by causing it to make a double line thus |=, by which it may signify a capital letter of the same kind as that described at the other end, or they may have any other mark to distinguish the different ends. I likewise distinguish one end of each type by adding a beard or hair line thereto, or any other mark, or by making it a little broader at one end. The shank of the type, which is more particularly described by the said drawing hereunto annexed, Fig. 1, forms one half part of a square, so that two of them united, as by drawing Fig. 5, *e e*, give a compound square type, capable of being used at both ends. From a combination of any two of these three types, by turning them in four directions at each end, result eight distinct marks or letters, from which I select such as are best calculated to signify letters, notes, figures, or points. The effect produced by the various combinations of these three types is more fully elucidated by the drawing hereunto annexed, Fig. 2 *. If I

* We must refer such persons as may be desirous to consult these elucidations, to the enrolment office, having omitted them on account

wish to increase characters upon the basis of the square, it is done simply by adding other such types, as before described, to form different kind of lines to those already chosen, which must be on similar shanks to those already described, defining the ends thereof in the same manner as directed for the three before-described types. The great increase of character, by the addition of types so constructed, may be seen by the specimens in the drawing hereunto annexed, Fig. 3 *, which are made simply by the addition of two other types, by which it will appear, that from these five types there may be produced a great variety of distinct characters; the ends of the types being wedge-like in every direction, admit of being so locked into the line frame, as described in the drawing hereto annexed, Fig. 5, that no letter can be drawn out of its place by the ball, as is the case in common types. The lines being thus independent, can be taken out of the page-frame and moved about without danger of discomposure of the letters. This is more fully seen by two sections of a line-frame, with types in them, in the drawing Fig. 4. When the types are to be used in the composition of any work, they may be taken from the lines of a former work by a pair of pliars in the act of composing, the labour of distribution being in this mode of printing entirely saved; and for this purpose I take two line-frames, an empty one and one full of letters, composing my old work. I place them on the composing-stick described by drawing Fig. 6, and in composing the new line I pick out all such characters out of the old composition as will suit for the new

count of the difficulty of introducing them, and considering them not very material to an understanding of the invention.

* See note on the preceding page.

[redacted]

one, and after exhausting all the characters this first line of an old composition will give me, I then put another line of such old composition upon the composing-stick, and proceed to compose from that, taking care, as occasion offers, first to exhaust the remains of the letters in the first line of old composition. As soon as a line is thus composed, it is to be transferred to the page-frame, as described by drawing Fig. 7. The lines are made first in the page-frame, by the pressure of two or more screws at the bottom of the page-frame, the points of which act against the steel slide bar Fig. 8, which, interposing between the screws and the line frames, prevents any partial pressure from injuring the line-frames. Being thus screwed into the page-frame, the page is ready to be printed from. Each end of the types bearing the same letter, the one a small letter, the other a capital, when any work is to be printed those parts which are to be small letters must appear with the capitals upwards in the act of composing, and the contrary for those parts of the work which are to be in capitals. A composition in this mode is the same as a writing made from the left to the right hand, and presents the same appearance on the composing-stick as the print to be made from it, except that it appears in capitals and small letters where the print is intended to be the contrary: hence the facility in composing and reading any composition. When the work is to be printed, the page-frames must be laid on the bed of the press with that side downwards which has been upwards whilst the composition was forming. The page-frames may be fastened on the bed of the press in the usual way. A greater or less space may be made between each letter by blank types, as described in drawing Fig. 9. When any

any letter is made by any single line in an horizontal position, the deficiency in the line-frame above or below such letter may be made up by a demi blank type, as described in drawing Fig. 10. The distance of the lines is regulated by metal or wood lines, of the same shape and size as the steel bar No. 8, but may be of different thicknesses.

To instruct in writing this character, or to enable a person to write it with mechanical precision, I use a frame of metal, Fig. 12, by following the sides of the square holes cut therein with a pencil or style. The habit of making square characters is soon attained; and any writing performed by means of this rule has nearly the exactness of printing, and by its use all hand-writings are uniformly alike. The difference between these characters written and printed will be observed by the drawing Fig. 2 *.

For musical notes I make choice of the simple horizontal character, which I print or write upon a stave of twelve coloured lines, Fig. 13, each line represents a tone or semi-tone, and is sufficiently wide to receive the treble, tenor, and bass parts on each line. The treble I put on the upper part of the line, the tenor in the middle, and the bass at the lowest part thereof. The keys or strings of such instruments as will admit of it I make of a colour to correspond with the lines on the music paper.

If in composing, the letters do not exactly fill the line-frame, I fill up the space left by a small wood or metal wedge after the letters are properly levelled on the stand of the page-frame. I make the said horizontal lines, which I choose for musical notes, of proportionate

* Omitted.

lengths.

lengths. The semi-breve one inch long, the minim half an inch long, the crotchet one quarter of an inch long, the quaver one eighth of an inch, the semi-quaver one sixteenth of an inch long, the demi-semi-quaver one thirty-second of an inch long: these, by their respective lengths, shew to the eye of the learner the proportionate duration of each note; but the precise duration of the tone intended to be expressed by any of these characters I ascertain more exactly by the time which the finger of the tonemeter is in passing over such characters. The tonemeter is described at Fig. 14.

In witness whereof, &c.

Explanation of the Plate.

Fig. 1, (Plate I.) *e e e*, impressions from the small end of the types. *f f f*, impressions from the large end of the types. *a b c* is a side view of the types, representing their breadth. *d* is a section of the types, representing their thickness. The types may be made of such materials as types are usually made of.

Fig. 4, *a* is a side view of the line-frame, which may be of any hard metal, as brass, iron, &c. *b* is a type placed in the line-frame to make an horizontal line or character. *c* is a type placed in the line-frame to make a perpendicular line or character. *e e* represents the opening at the top of the line-frame to receive the types.

Fig. 5, *a a*, section of the line-frame Fig. 4, with a type in it to produce a perpendicular line or character. *b* is the type in the line-frame. *c* is that point of it from which a print is intended to be made. *d d* is that part of the line-frame which, by its curvature, prevents the

the types from passing through the frame when a line is moved from the composing-stick, and which also prevents letters from being drawn out of their place by the balls. *e e* is another section of the line-frame, representing the position of a compound type to form an horizontal character.

Fig. 6, *a a* is the composing-stick, consisting of a brass or iron box without a top, and with only one side, made sufficiently long to receive the line-frame, which hangs on the edges of the ends thereof. The depth is such, that the types will touch the bottom of it before they become pressed by the bevelled part of the line-frame, as represented in Fig. 5, at *d d*.

Fig. 7, page-frame. *a a a a* is a frame of brass, iron, or other metal, to receive the lines as soon as composed in line-frame. *b b* are two screws to fasten the line-frames in the page-frame. *c c* is a line-frame in its place on the page-frame. *d* is a type in the said line-frame, the bottom part, *e*, of which type rests upon the leveling stand *f*. *f* is a stand for the page-frame, made of well-seasoned mahogany, and placed perfectly true; upon this the face of all the letters in the line-frames are made to bed before they are screwed up. *g g* are two strips of wood on which the page-frame rests, which keep it at a uniform distance from the surface of the stand on which the letters are to be gently pressed before the lines are screwed in. *h h* two strips of brass, to keep the page-frame in its place.

Fig. 8, steel bar, against which the page-frame screws act. *a a* are two projections on which the bar hangs on the edge of the page-frame.

Fig. 9, blank type. *d* is a projecting head, which rests on the edges of the line-frame. *b* is the square

shank

shank part, which is of the same dimensions as the shank of the letters, and fits into the line-frame, and is a little bevelled at the bottom on all sides. *c* is a side view of the blank type.

Fig. 10, demy blank type. The demy blank type is the blank type Fig. 9, cut through the middle so as to retain a projection on one side of each piece only, as represented at *a* and *b*.

Fig. 12, guide frame. This is a strip of steel or brass, or any other hard metal, about the thickness of a sixpence, with holes pierced in it of the size of the letters to be made.

Fig. 13, coloured music stave.

Fig. 14, *a* is a box which contains a spring 18 inches long and ½ wide. *b* a fusee wheel with 60 teeth. *c* a wheel with 60 teeth and its spindle 7 teeth, turned by the fusee wheel *b*. *e* a wheel with 24 teeth, communicating motion to the fly-wheel *f*, by means of a worm. *g g g g* are four wings on the fly-wheel. *h* a ribbon passing over the pinion *e*, and communicates motion to the roller *i*. *k* a ribbon communicating motion to the roller *e*, and has the two indexes *m m* fixed at opposite ends of the ribbon, which by passing over the music paper *o*, shews the time of each note. *n n n n* four supporters for the rollers. *p p p p* four pieces with screws to fasten it to the music-stand. *s* the handle. *t* the catgut. *v* the spring and clock.

Specification

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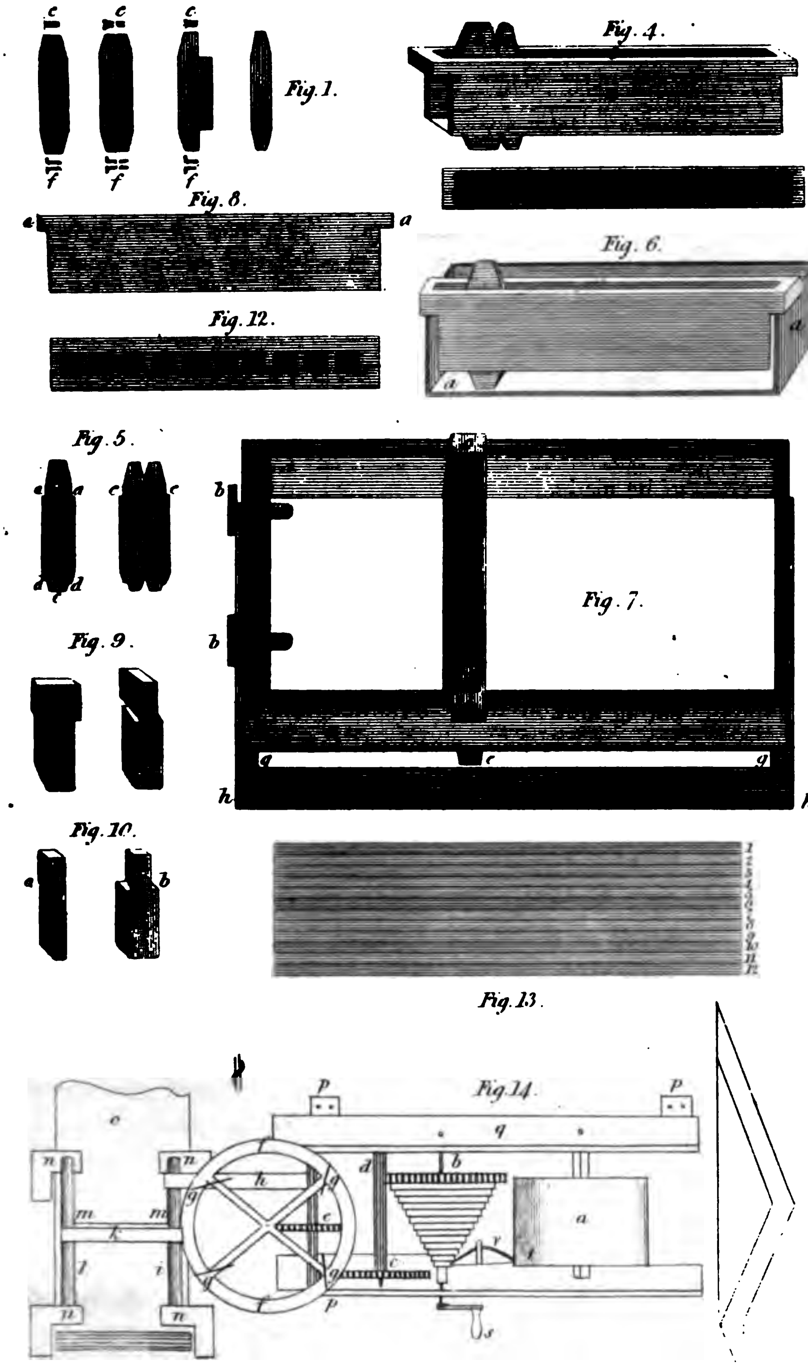

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Specification of the Patent granted to FREDERICK ALBERT WINSOR, *of Pall-mall, in the County of Middlesex, Esquire; for a fixed Telegraphic Light-house, and also a moveable Telegraphic Light-house for Signals, and Intelligence, to serve by Night and by Day, in Rain, Storm, and Darkness, in any required Direction, and from any given Centre.*

Dated August 3, 1809.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Frederick Albert Winsor do hereby declare that my said invention is described in manner following; that is to say:

The telegraphic light-house consists, first of a plain or hollow mast either fixed or raised, and lowered at pleasure according to the local situation; a lanthorn of a large size is fastened at the top, which may be furnished with lenses or reflectors to increase the light; this may be produced either of gas conveyed by a flexible or metal tube from a furnace below, or by oil lamps placed within the lanthorn.

These lights may be multiplied to any number, and be arranged in different divisions above each other, so as to leave some visible space between them, for if only one row or circle of light is given, it might be mistaken at great distance for a star, which is often the case at sea with those light-houses that have no revolving lamps to avoid such mistakes; if only one row, circle, or division of light is given, a pure gas flame or oil lamp

[redacted]

should be fixed at a certain height above the lanthorn. My gas flame burns in the form of a vane or weathercock, shewing the directions and variations of the wind in the darkest of nights, which no storm or rain can extinguish.

This being a central light it is seen from every point of the compass; but the greatest utility consists in the application of it for signals and telegraphic dispatches by night as well as by day.

For example: such a light-house is to serve for a head telegraph in a metropolis, in fleets, or armies: the private signal to prepare for dispatches (which signals of course differ as to the number of corresponding telegraphs immediately surrounding it) is given, say from London to Portsmouth, when the next corresponding telegraph in the road to Portsmouth will answer the signal, whilst all the other surrounding ones, though they observe the head telegraph at work, will remain inactive until they observe their own peculiar signal for preparation.

In this manner one central telegraph may correspond with any number of surrounding ones, by only reserving a distinct signal for preparation for each; whereas the present central telegraphs of the metropolis now in use, will only serve for one direction or one point in the compass, and there must be as many central ones as there are next surrounding telegraphs.

A great variety of signals may be made by transparent skreens of different plain and variegated colours, made to slide over the lanthorn by ropes and pullies, all fitting one into the other like so many hoops of different diameters shutting up in one box; and if the lanthorn is pretty high, all these coloured transparent hoops may

be

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be used as single or as compound numbers, agreeable to any telegraphic alphabet or numerical dictionary; a number of opaque hoops will answer the purpose if the lanthorn is very long, for they will form different shades at the distance, and appear like a luminous finger with so many black rings on it, which can be varied in numbers as well as in visible distances from each other; these lanthorns may be made from a circle to a triangle, from a square to an octagon, but the round or circular ones are visible only from every point of the compass; whereas, the triangular, square, octagon, &c. can only present so many different phases as each of these forms contains, unless indeed they are so constructed as to turn upon their own axis, like as a windmill is turned towards any point from which the wind blows, when every phasis of the lanthorn may be turned towards each corresponding telegraph to transmit dispatches by signal.

Secondly. The telegraphic light-house is made moveable, to correspond at different parts of the sea-coast, or any where when no fixed telegraphs are erected; for instance: A vessel at sea in distress fires guns, or makes other signals of distress; a moveable telegraph may be brought by a horse and cart nearest the opposite point to give signals that relief is preparing, and to give directions of any kind to the poor mariners in distress.

This telegraph may also be of great use to armies, and during any battle or engagement may serve to convey orders from the commanding General to any and the most distant corps, whereby great time is saved and a variety of manœuvres can be executed against the enemy with the greatest celerity.

[redacted]

This machine is constructed on the principles of the lazy tongs which shut up in a cart, and is raised to any length from thirty to sixty feet and more with great facility and expedition; it may follow the commanding General every where, and become more serviceable than any number of aide-de-camps or adjutants with the swiftest of horses, provided the same mode of conveying orders by signals is introduced in the army, as is actually used in the navy.

In witness whereof, &c.

Specification of the Patent granted to the Honourable JOHN LINDSAY, *(late Lieutenant-Colonel of the Seventy-first Regiment,) of Grove House in the County of Middlesex; for a Boat and various Apparatus, whereby heavy Burthens can be conveyed on shallow Water, on Rivers wherein Shoals and other Difficulties impede Navigation, and whereby the Lives of Men will be saved from Wrecks, and other Situations of imminent Danger at Sea, or on Rivers; and whereby the Apparatus above specified may in its Consequences and Construction embrace other important Results, highly beneficial to the British Navy and Commerce, by enabling the Bottoms of Ships to be examined with Accuracy and Expedition, without the Necessity of moving the Masts or Cargo.*

Dated June 19, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Lindsay do hereby describe and ascertain the nature of my said invention, and in what manner

ner the same is to be performed, in manner following; that is to say: My boat, for the purpose of the conveyance of merchandize of all descriptions, on rivers or shoal water, may either be a barge, boat, or any other vessel, the flatter the better. When the boat or vessel is loaded with a cargo, and after having proceeded part of her voyage, is stopped in her progress by a shoal of rock or sand, which frequently occurs in the summer in rivers that are at other times navigable, I then place on each side of the loaded vessel a long flat trough, the sides of which two troughs, which I call lightners, are considerably higher from the surface of the water than the loaded vessel that is now placed between the two said troughs or lightners. Having thus placed my three vessels abreast of each other, I place two strong beams, which I call depressers, across the three vessels, which beams may be placed twelve or fifteen feet asunder, but equidistant from stem to stern of my boat. The loaded vessel has fixed in a strong kilson in her bottom two powerful screws, and of length higher than her gunwale; the said two beams or depressers, having holes bored in the centre of them, receive the heads of the two screws; two capstans, with bars, being fixed in the head of each screw, the vessel, which is loaded, becomes by the action of these elevated screws, gradually raised, while two beams are laid across the vessel and lightners, so that by raising the loaded vessel, and depressing the lightners at the same time, the weight is divided on the three. When the shoals and difficulties in a river are so great in places that the lightners cannot enable the loaded vessel to pass; in that case I make use of a number of water troughs, which I call moveable

able weirs; the first of which I fix, with a kedge anchor, on the opposite side of the river when the vessel is to pass the shoal; and by attaching a number of these moveable weirs to each other in a diagonal position, and by placing a tarpawling along them, to prevent the escape of the water, I sink the said weirs by weights in the river, by which means I direct the current of the river into so narrow a channel that the increase of water will so deepen the shoal that the vessel and apparatus will be enabled to pass the said shoal, and thereby continue her voyage. And when the stream is too narrow and shoal for the barge and lightners both to float, the barge may be buoyed up so as to be clear of the bottom when the lightners must necessarily be stranded. In this case two iron wheels are requisite at the ends of the beams to run in a trough, affixed above the gunwales of the trough in the centre; and by securing the cable by anchor, or otherwise, the vessel may, with her windlass, be warped off by degrees. And as to that part of my right for a patent as relates to this boat and apparatus being capable of saving the lives of men from wrecks, and other situations of imminent danger at sea, or on rivers, I relinquish all claim to patent-right on that subject, as well as the application of similar powers to those of this boat and apparatus, enabling the bottoms of ships to be examined with accuracy and expedition.

In witness whereof, &c.

[redacted]

Account of the Rail Roads on the late Lord Penrhyn's Estate near Bangor, North Wales.

By Mr. BENJAMIN WYATT, *of Lime Grove.*

With an Engraving.

Communicated by the Author, in a Letter to the Editors.

GENTLEMEN, *Lime Grove, April* 20, 1811.

ABOUT nine years ago you did me the favour to insert in your useful publication an account of the late Lord Penrhyn's rail-road; since then, even to this time, I have had frequent applications for further particulars relating to it. As I find it inconvenient to answer all these enquiries, yet desirous to furnish every information in my power, I must beg leave to resort once more to the Repertory as the means of doing it. In the first place, after eleven years practice, I must observe, that we still continue the use of this road in its original construction, except the sills, which were then of wood, but are now of cast iron, agreeable to the drawing herewith sent. (See Plate II.) The rail and wheel I would wish to alter to the form of the drawing, as we find the oval rail to wear the concave rim of the wheel very fast into a hollow, fitting so tight upon the rail as to create a good deal of friction, and obliges us to change the wheels very often. This I apprehend would be entirely removed by substituting a rail and wheel of the form of the drawing. I know of nothing else I could wish to alter.

I am,

GENTLEMEN,

Your most obedient humble servant,

BENJAMIN WYATT.

Ex-

EXPLANATION of the ENGRAVING. (Plate II.)

Fig. 1, section of the rail, wheel, and sill.

Fig. 2, plan of one end of sill.

Fig. 3, section of rail and sill, rails two feet apart.

a, rail, 4 feet 6 inches long.

b, flaunch cast at each end of the rail, 2 inches long, to slide into the dovetail of the sill *e*.

e, sill of cast iron.

c, wheel, 14 inches diameter, of cast iron, weight 35lb.

The dove-tail of the sill at *a* is 1¾ inches wide at bottom, and at *b* only 1½ wide. The top 1 inch at *a*, and at *b* ¾ of an inch. Weight 14lb.

Machine for separating Iron Filings from their Mixture with other Metals.

By Mr. J. D. ROSS, *of Princes-street, Soho.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

THE object of the machine I have invented is to separate iron filings, turnings, &c. from those of brass or finer metals, in place of the slow and tedious process hitherto employed, which is by a common magnet held in the hand. By my invention many magnets may now be employed at once, combined and attached to a machine on a large scale. The magnetic hammers are so contrived as to take up the iron filings from the mixture of them with other filings, or metallic particles, placed in

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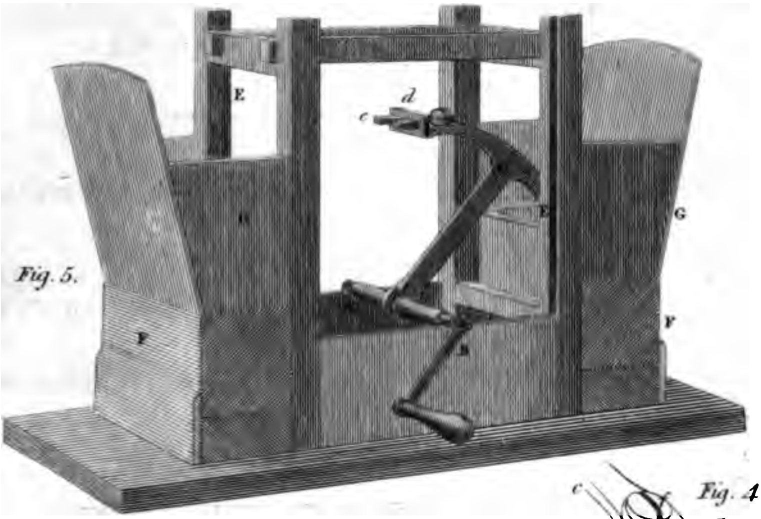

Fig. 5.

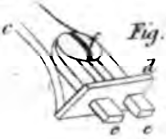

Fig. 4.

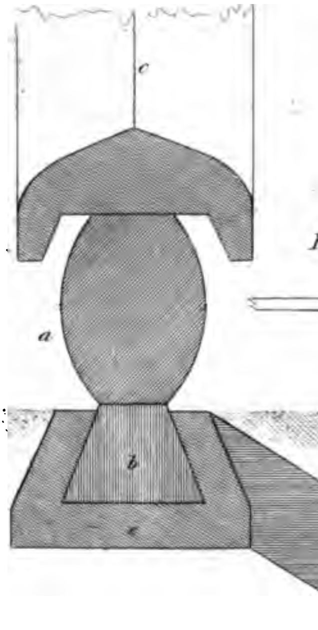

Fig. 1.

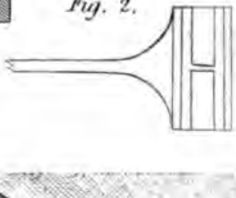
Fig. 2.

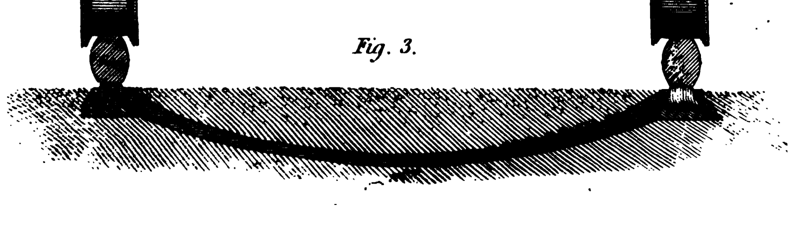
Fig. 3.

[redacted]

in the trays or end-boxes, and drop them into the receiving box in the centre, which is effected by the alternate motion of a winch-handle, working the two magnetic hammers placed at two angles of a quadrant or anchor. In proportion to the power of the magnets and to the force of the blow given by the hammers, a great quantity of iron is separated from the brass, by the alternate motion, and dropped into the receiver placed in the centre of the machine.

I have shewed the model to persons engaged in various metallic works, who give me great encouragement by their signatures and sanction.

The following persons certified that they consider Mr. Ross's invention of a machine for separating iron filings, turnings, &c. from those of brass or finer metals, as likely to prove extremely useful in various branches of workers in metal.

Thomas Charles King, Founder and Plater, No. 10, Brownlow-street.

Calvert and Dowey, Hart-street, Covent-garden.

William Shawler, Litchfield-street.

J. Asquith, Metal-turner, St. Martin's-lane.

Charles Bond, Old Compton-street, Soho.

John Turmeau, Goldsmith, Carleton-place.

J. Perigal, Watch-maker, 55, Princes-street, Soho.

George Hall, Gold-worker, 482, Strand.

P. Storr, Silversmith, Dean-street, Soho.

H. Hall, Coach-plater, 5, Cross-lane, Long Acre.

W. Williams and Son, Button-makers and Silversmiths, 103, St. Martin's-lane.

REFERENCE to the ENGRAVING.

(Plate II. Figs. 4 and 5.)

A is an axis of brass, and B a handle upon the end of it. C is a piece of brass in form of an anchor, at each end of which a horse-shoe magnet is fixed, in the manner shewn at Fig. 1, where *c* is the arch of the anchor, and *d* a piece of brass, having a hole through it to receive the legs *e e* of the magnet, which is fixed to the arch by a screw *f*, tapped into the arch. The anchor is mounted upon the pivots of the axis A, in a frame E, which incloses it. On the outside of the frame two blocks of wood, F F, are situated; in each of which a hollow or tray is formed to receive the filings, which are to be separated from the iron they contain in these hollows. The magnets fixed at the ends of the anchor strike upon the filings, and select, by the magnetic attraction, all the iron among them; the anchor is then turned over by the handle B, and the opposite magnet strikes in the other hollow F; at this time the other magnet is just over the axis, and by the jerk of its opposite striking the block F the iron filings are shook off, and fall down in the bottom of the frame or receiver; in this manner the handle B, being moved backwards and forwards, strikes the magnets alternately in the two blocks F, at the same time that one strikes the opposite is cleared from the iron it has picked up by the shock. G is a screen of thin board, to prevent the filings being scattered.

Method

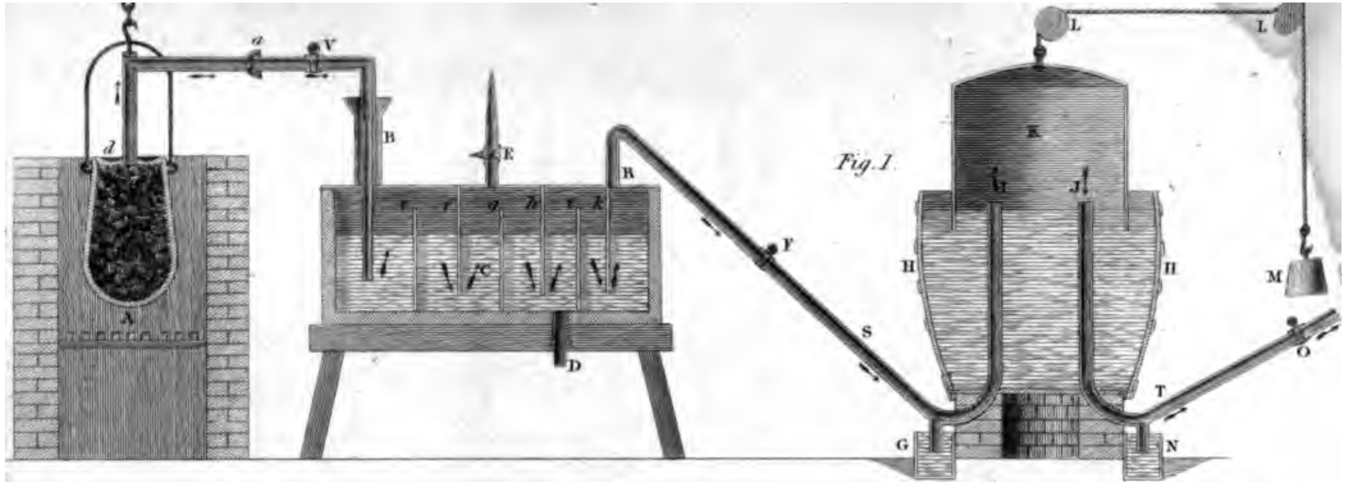

Fig. 1.

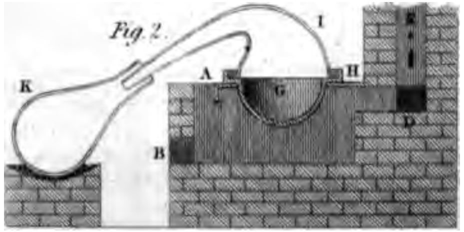

Fig. 2.

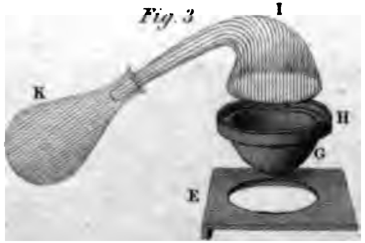

Fig. 3

Fig. 4.

[redacted]

Method of producing Heat, Light, and various useful Articles, from Pit-coal.

By Mr. B. Cook, *Birmingham.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

With an Engraving.

The Silver Medal was presented to Mr. Cook *for this Communication.*

Having paid much attention to the procuring of gas, and other products, from pit-coal, I now beg leave to lay before the Society for the Encouragement of Arts, &c. the results of some of my experiments on pit-coal, and the methods of procuring the sundry articles of which I have sent samples, and a japanned waiter varnished therewith. The quantity of clear tar which may be produced from every hundred weight of coal is about four pounds, from which a liquor, or volatile oil, may be distilled, which answers the purposes of oil of turpentine in japanning. Every gallon of tar will produce nearly two quarts of this oil by distillation, and a residuum will be left nearly, if not quite equal, to the best asphaltum. I have sent a waiter, or hand-board, japanned with varnish made from this residuum, and the volatile oil above mentioned. This dries sooner, and will be found to answer as well as the best oil of turpentine, a circumstance which will be of immense advantage to this country, as in the vicinity of Birmingham only, nearly ten thousand tons of pit-coal are coked or charred *per* week; and all the tar hitherto been lost; but by my process, I dare venture to say, that from the

D 2 various

various coal works in this kingdom, more tar might be produced than would supply all our dock-yards, boat-builders, and other trades, with tar and pitch, besides furnishing a substitute for all the oil of turpentine and asphaltum used in the kingdom, and improving the coke so as to make irón with less charcoal.

I have sent a large specimen of the asphaltum, and three vial bottles containing as follows:—

No. 1.—A sample of the oil or spirit, being part of that which was used in making the varnish with which the waiter sent was japanned.

No. 2.—Is the same oil or spirit, a little more rectified.

No. 3.—The same, still further rectified, and of course more clear, and freer from smell; but I find that the specimen, No. 1, answers quite as well for varnish.

Tar-spirit is now about 8*s.* *per* gallon, and turpentine-spirit about 15*s.*; this latter has been, within the last two years, as high as 48*s.* *per* gallon, and the tar-spirit will answer equally as well for varnish, as you will observe by the inclosed Certificate from Mr. Le Resche, on using the coal-tar-spirit, instead of the turpentine spirit.

I requested Mr. Le Resche to use the tar-spirit just in the same way he would the foreign spirit, and then give the varnish to his work-people to use, without making any remark to them, which was done: he, making the varnish himself, found it mixed, and made the varnish as good in appearance as that prepared with the foreign spirit. He then gave the varnish to his work-people to use, and when they had finished their work with it, he found from their report, that it answered perfectly, and dried sooner; and when the waiter done

with

with it was given to the polisher, it was found to polish much smoother under the hand, and take a more beautiful gloss than their former varnish, as the article now sent will shew on inspection.

I am of opinion that the production of these articles will be of great public service. Permit me to add, that the timber of ships paid with this tar is not nearly so liable to be worm-eaten as those done with common tar.

The following CERTIFICATE *was received from Mr.* LE RESCHE, *who prepared and applied the Varnish of the Waiter sent to the Society.*

This is to certify, that the spirit or oil, extracted from coal-tar, is every way adequate to the purpose for which it is intended, as a substitute for the foreign spirit or oil used in japanning.

Mr. Cook having desired me to make a trial of it, the tray, or waiter, accompanying this paper, was got up in my manufactory, and is a specimen in proof of its usefulness. The varnish used for that purpose I made myself, and instead of mixing it with the usual spirit or oil imported, which is now become excessively dear, I mixed it with the spirit, or oil, extracted from coal-tar; and as I can truly affirm, that far from its being a substitute inferior in properties to the spirit in general use, I esteem it far superior in several respects.

In the trial I made of it, I found it would dry quicker, and the varnish mixed with it would polish with more ease, bear a good lustre, and, in short, answer every requisite purpose of the foreign spirit. If to these be added the reasonable price at which it may be sold, I cannot but pronounce it a discovery that must eventually prove

prove greatly advantageous to the manufacturer, as well as interesting to every lover of the arts, or admirer of talent and ingenuity.

Reference to Mr. COOK'S *Apparatus for preparing Gas and other Products from Pit-coal.*

A, Fig. 1, (Plate III.) is a common fire-place, a stove built with brick, having cast-iron bars to put the fire in at, and a flue that goes into a chimney; A is the cast-iron pot, (which holds from twenty-five pound to one hundred pound of coal, according to the size of the premises to be lighted) which hangs by the bewels or ears on a hook, suspended by a chain in this stove or furnace, about three inches above the bars of the grate, and three inches distant from the sides of the stove; the fire then flames all round this pot, and as it does not rest on the burning fuel, it is the flame only that heats it, so that it does not scale, but will last for years. The smoke, &c. is carried off into a chimney. The cover *d* of the pot is made rather conical, to fit into the top of the pot close, and from the top of the cover the elbow-pipe proceeds as far as the mark *a*. The other end of the pipe with the elbow entering the water-joint is rivetted to it after; when the lid or cover of the pot is put on, the bewels or ears come over the elbow of the pipe that is on the lid, and a wedge is put between them and this elbow, to keep down the cover air-tight, and a little clay or loam may be luted in the joint, if any gas should escape round the cover of the pot. The other elbow B goes into a water-joint, formed of a tube affixed to the cover of the purifier C; and another tube, which passes through the lid of the purifier: the elbow-pipe then goes

[redacted]

goes over the inner tube, and when put on, the jointing is made good by pouring water into the space between the tubes, which renders it air-tight. The gas, as the arrows shew, passes down into the purifier C, which is rather more than half full of water; the use of this water-joint is for the convenience of removing the lid *d*, to which this pipe is attached. The purifier C is a wooden trough, with a sheet-iron top, to which the tubes are soldered, and it is fastened to the trough to keep all secure and air-tight. The sheets of iron, *e*, *f*, *g*, *h*, *i*, *k*, are alternately soldered to the iron top, and fastened to the wooden bottom. Now when the trough is half filled with water, the gas passes into it at B, and as it can only find its way out again at R, it must pass through the water. The inner pipe B reaches under the surface of the water in the trough; now when the gas is forced into the water, it would rise to the top of the purifier, and go along in a body to the end, and out at the pipe R, if the sheets of iron, *e*, *f*, *g*, *h*, *i*, and *k*, which stand across the trough with openings in them, alternately at top and bottom, did not stop it, force it to descend down into the water, and hinder it from going any way but through these apertures, purifying it all the time it is passing through the whole body of water, until it is properly washed; it then escapes through the pipe R at the end of the trough C, then passes down the pipe S, and is carried up into the reservoir or gazometer K. In the bottom of the purifier is an aperture, closed by a plug at D, to let off the ammoniacal water and tar as it is deposited, and the pipe, with the cock E at the top of the purifier, is to burn away the spare gas when not to be used.

There

There is a stop-cock placed in the main pipe, at F, that when the reservoir is full, and gas is making, and cannot be used, the cock may be turned, and prevent any gas from passing from the reservoir, and by opening the cock E on the top of the purifier, and firing it, all the gas which is made more than is wanted for use may be burnt away. If this was not done, the gas would continue to find its way into the reservoir K, which would overflow, and produce a disagreeable smell, which this simple way of burning it away as fast as it is made when not wanted, prevents.

It may in some measure happen, that although the gas has passed through the purifier C, yet that a small portion of tar will pass along with it, and would either clog the pipe S, or accumulate in the reservoir. To avoid this, there is placed at the bottom of the pipe S at G, before it rises into the reservoir, a jar into which a pipe made, as shewn in the drawing, conducts the tar; this collects all that passes through the purifier; it is filled with water, over which the gas passes up into the reservoir, but the tar-drains down this lead pipe and deposites itself in the jar of water. The longer this pipe S is, the better, as it serves as a refrigitory. H is a plain cask, made to any proper size, and filled with water, with a cock to draw off the water when it becomes foul. The upper vessel K is made of sheet iron, rivetted together in the manner engine-boilers are made. If it is only from five hundred to one thousand gallons in size, it will require only two cross iron bars at top, and four ribs down the sides to keep it in form, with a strong ring at top; and as there is no stress on this vessel, it will ascend and descend easily without any other support or framing, the plain sheet iron sides being rivetted

rivetted to the four ribs, and it is quite open at the bottom. A strong rope runs over the pullies L L, with a weight M to balance the vessel K, and assist it in rising and falling. The pipe J is that through which the gas passes from the reservoir or gazometer, and rising through the pipe T, is conveyed to all parts to be lighted. There is also another drain-pipe at N, for after all the washing, &c. a very small portion of tar and moisture may rise into the pipes, and perhaps in time clog them, but by laying all the pipes in the first, second, and third stories on a small descent, if any tar or moisture should rise, it will drain down all the pipes from top to bottom, and be deposited in the earthen jar at N, by that means the pipes will not clog up in half a century. These jars must be sometimes removed and emptied, fresh water put in, as also the water in the vessel H must be changed, to keep it clean and sweet; and the water in the purifier C should be changed every two or three days: by these means the gas will be deprived of all its smell, at least as far as washing will effect it, and the apparatus will be clean.

The stop-cock at O is for the use of a master, if he wishes to lock up the gas in the reservoir, to prevent his workman, &c. wasting it in his absence, as also if any pipe should leak, or a cock be out of order, in any part of the premises, by turning this cock all the gas is kept in the reservoir while the pipe is repaired, or any other alteration made; it also extinguishes all the lights when turned, if any are left burning by careless workmen, nor can they be lighted until it is opened again.

The whole of this apparatus is simple, and not liable to be put out of order in such a way, but that any person may put it to rights again. All the art required to make

 the

the gas is to take off the cover of the pot, and without removing the pot to take out the coke, and fill it with fresh coal, wedge it down by putting an iron wedge between the bewels or ears and the elbow of the vessel, and if required, plaster a little clay or loam round the cover, to keep it air-tight, a fire is then made under it, and the whole is done. The boy or man who does it, must now and then look at the fire and keep it up, until the pot is hot, and the gas is made. Now in works where lights are wanted almost always, I would recommend two fire-places, and two pots, so that when one pot is burned out, the other pot may be ready to act; for this purpose the purifier must be provided with two of the water-joints B, one communicating with each pot, and the elbow-pipe of each pot must have a stop-cock, as V: now when one pot is burning, the cock in the other pipe must be stopped, that the gas may not find its way out of the purifier, and when all the gas is extracted from that pot, the cock C, leading from it, must be stopped, and the pot left to cool; while a fire is put under the other pot, its cock is opened, and a supply of gas from it is passed into the reservoir; by these means one of the pots is constantly supplying the reservoir with gas, and the lights are always kept burning; one purifier is all that is necessary; the cock V must be shut when either of the covers are taken up to fill the pot again with coal; when the elbow-pipe is lifted out of the water-joint, as the cover is attached to it, a plug must be provided to fit into the water-joint pipe the moment the elbow is removed from it, or the gas will rush out of the pipe at the water-joint; but a better way would be, to lengthen the pipe of the water-joints B, and place a large cock under each of them, almost close

to

to the top of the purifier; when one pot is burnt out by turning the cock it keeps all the gas in the purifier while the cover is removed: no plug is necessary in this method. When people are very particular, (especially when houses or accompting-houses are to be lighted), and wish all smell to be destroyed, if they are not satisfied with washing it, and still think there is a little smell left, (and very little indeed, if any, will be left), after the washing, a small trough may be added, made in the same way as the purifier, with sheets of iron across to force the gas through the pipe R communicating with it. This trough may be filled with water, with a few lumps of lime put into it, and this water and lime changed often; on the gas being forced through this lime-water, if there was any remaining smell in it, this would completely take it away, and, as has been before observed, by changing all the waters now and then, and keeping this small trough constantly supplied with clean water and lime, the gas after passing it will ascend the pipes to the lights pure.

I hope to lay before the public, in a short time, an account of the establishment of a work that will be of such magnitude, as will supply this part of the country with the oil or spirit, in sufficient quantity to supersede the use of turpentine, &c. in japanning; and I do hope that in time works of the same description will be established through all Staffordshire, whose products will supply the place of a great portion of the spirit used in the kingdom, while the pitch will be of sufficient quantity to form a great part of that article now used in the dock-yards.

All I want is support from the great coal companies and masters, to erect sufficient apparatus at the different

 works

works to preserve the tar at all the coke furnaces, and proper means to separate the spirit from the tar. It would be a great saving to the nation, as in every one hundred and twelve pound of coal coked, there is lost by the present mode about four pound of tar, and the cokes are not half so good as if they were coked in close vessels, to the exclusion of the atmospheric air. I need not describe the method by drawings of the manner of extracting the tar from pit-coal in close vessels, as that method is so generally known; it must be clear to every one, that it is procured by distilling the coal.

I have, as follows, described the method I use in extracting the spirit from the tar, the process of which is so simple that every one must understand it.

Fig. 2 (Plate III.) is a section of the furnaces, and one of the retorts, almost any number of which may work in a line, the same flue will do for all, only taking care, if any are not at work, to stop up the draught-hole, which communicates with the flue. These furnaces are built without bars, grates, or doors. A is the place where the fewel is put in to heat the retort G, the fire lies under it, and the smoke is carried off into the flue F. B is the aperture where the ashes are raked out. G is a section of the iron bason, or lower part of the retort; the dark-shaded square part shows the space the fire occupies, and the black square D the flue as it runs along the back of all the line of furnaces, and enters the chimney R, as the arrows shew. I, Figs. 2 and 3, shews the upper part of the iron, earthen, or glass retort, fitted on the cast-iron bason G. K, the receiver. By this mode of setting the retorts, all the great expense of bars, doors, frames, &c. are saved, and a brisker draught of air is obtained, which may be slackened at pleasure by

by covering up in part, or wholly, the fire-place A with a brick. E is a square iron plate with a circular hole in the centre, built on the top of the furnace. The cast-iron bason of the retort G is made to the size of the hole in the plate: the most convenient size of the bason of the retort I find is about five or six gallons, in the shape of a deep pot, with a flanch or rim H round the edge of it; this pot or bason of the retort is put into the iron plate E, and the flanch of the retort then rests on the plate E. I is the upper part of the retort without a bottom, made to rest and fit on the flanch of the cast-iron bason G. K is the receiver, larger in the mouth than the nose of the retort. To begin the work, I fill, nearly, the iron bason of the retort G with coal-tar. I then put on the upper part of the retort I, and make it air-tight with a little sand thrown round it at the flanch H; the receiver K is put in its place, and a slow fire is put in at A, under the retort; the tar soon begins to boil slowly, or rather simmer; now as soon as that begins there rises from the tar a thick whitish vapour, which fills the glass retort, part becomes condensed, and falls in drops from the sides of the retort into the tar again, while the purer spirit rises into the neck, is condensed, and keeps dripping down the neck into the receiver; this is the spirit of the tar, and with this spirit that first arises from the tar was the waiter japanned which I sent you. The reason I chose to have the receiver wider at the mouth considerably than the nose of the retort is, that there is a strong and very volatile oily ammonia, that does not soon condense, but gets out of the receiver into the air the instant it leaves the retort, and though but in a very small quantity, so small that it is hardly possible to catch it; yet will it impregnate the air

air for a great distance round, with its very penetrating smell, while the spirit keeps dropping into the receiver pure and separate from the ammonia. The spirit is very volatile, quite as much so, if not more, than the spirit of turpentine, and soon evaporates if exposed to the air, which is a proof of its drying nature; indeed when used as a substitute for turpentine, it dries in the stove quite as soon or sooner, and takes equally as beautiful a polish. I send you three specimens, No. 1. is what came off the tar first. No. 2. is the same distilled a second time; and the third specimen is the second re-distilled again in a glass retort: it there leaves a little pitchy residuum, and comes over clear, as the sample. Very little of the spirit is lost in passing through these different stages, if care is taken that the fire is slow and the process not hurried. When the spirit is perfectly extracted from the tar, there remains in the bason of the retort that beautiful pitch or asphaltum sent, which when mixed with the spirit, forms an ingredient for making the black varnish used in japanning. If it is wished to use it as pitch, less spirit must not be extracted from it. I find that six gallons of tar will produce, if care is taken, about two gallons or two gallons and a half of spirit. A great number of retorts may be kept working by a single man; if we say only one hundred, and only worked down in a day, they will produce two hundred to two hundred and fifty gallons of spirit, so that by increasing the number, any quantity may be obtained. When the spirit is used in the place of turpentine, the varnish-maker uses it in the same way, and in the same quantity, as there appears no manner of difference in the use of it from spirit of turpentine in the making of varnish. When the asphaltum is used, it supplies the place of

real

real asphaltum, and in about the same quantity. I have explained the whole as clear as I can; but if any more information is required, I should feel happy in giving it.

*** To such persons as wish for further particulars on the subject of lighting apartments with gas, it may be proper to note, that the Society, in their twenty-sixth volume of Transactions, page 202, have given an engraving and description of a gasometer, and apparatus for making carbonated hydrogen gas from pit-coal, which communication was sent to them by Mr. S. Clegg, of Manchester *.

Method of procuring Turpentine and other Products from the Scotch Fir, (Pinus Silvestris, Linn).

By Mr. H. B. Way, *of Bridport Harbour.*

With an Engraving.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The enormous high price of turpentine, tar, and pitch, last year, brought to my remembrance, that I had, in 1792, when in America, made some memorandums on the subject of obtaining them in North Carolina, which, on referring to, led me to think that they might be obtained in this country. I was induced to mention it to my relation and friend, John Herbert Brown, Esq. of Weymouth, and of Sheen in Middlesex, when on a visit at my house; and I expressed a wish that I could try the experiment with regard to turpentine, when he very kindly gave me leave to try it on

* See the 15th volume of the present series, p. 325.

three

three trees growing on his estate, about three or four miles from this place, and he went with me and fixed on them, and early in last April I had them prepared for the purpose of extracting the turpentine, and they have been running till the 18th instant. The weather, except the last month and part of this, has, from so much rain falling, and there being so little hot weather, been particularly unfavourable for this business, as the distance being such as to prevent the trees being regularly attended, the hollows were frequently found by my men full of water, and a good deal of the turpentine, which run off with the water, lay on the ground. Under all these circumstances I was only able to obtain from the three trees about two pounds and a half of turpentine. Mr. Brown being with me again the 16th and 17th instant, as he wished to take the trees down, I begged he would allow me to take a part from one of them, for the purpose of sending to the Society of Arts, Manufactures, and Commerce, with the turpentine collected from the trees, which he most readily complied with. I have, therefore, taken about six feet from one of them (they were all nearly the same size); what I have sent is the part from the ground to the top of the place that has been cut away for the turpentine to run into the hollow, from whence it was to be collected. The hollow was cut in this considerably higher than is usual in America, as this tree stood in a hedge, and could not well be hollowed lower. I have matted up this part of the tree, and secured it with straw and a double mat, to prevent the bark being rubbed off, that it may be seen in the same state as it stood when the turpentine was taken from it. The turpentine is in the cask in which it was deposited when brought from the trees; and I have this day

day shipped both on-board the sloop Betsey, Captain Trent, bound to Downe's-wharf, London, directed to you, freight paid here by me, which vessel I expect will sail in a day or two, and I hope you will receive them safe; which, when you do, you will much oblige me by requesting that both may be examined, in the hope that this small trial may meet with the approbation of the very highly respectable and truly useful Society of Arts, Manufactures, and Commerce; and if considered likely to prove useful, that they may induce some person who has the means and opportunity of doing it, to make a trial on a large scale, so as to fairly ascertain whether turpentine can be obtained in this country from the very large and numerous plantations of Scotch firs now in the United Kingdom, previous to the trees being cut down, either to thin plantations or where ground is designed to be cleared, as taking the turpentine from the trees previous to their being cut does not at all injure the wood; and by making the hollow in the trunk of the tree about six inches from the ground, it would waste but a very small quantity of timber. I have taken the liberty of annexing a copy of memorandums I made when in North Carolina, respecting the modes of collecting turpentine, and making tar and pitch, in hopes they may afford the Society some little information, as they are not, I apprehend, very generally known. They are copied from memorandums, which I actually made on the spot. I would have sent the memorandum-books, with this, had not the remarks been mingled with others relative to my commercial pursuits; but I shall have no hesitation in allowing any persons to examine them, or to afford any information in

in my power to any persons willing to make experiments in this way, if they will favour me with a call. I am well satisfied in my own mind, that very large quantities of tar might be obtained from the knots and limbs of the Scotch fir when cut down; and that the charcoal made from it would not be injured by the tar being first extracted. And as I was in Norway, Sweden, and Russia, in 1789 and 1790, and saw no trees from which I consider that tar could be extracted except the Scotch fir, or red deal, which is one and the same tree, I am persuaded that the refuse of that tree must be what they make the tar from in those countries, though I had no opportunity of seeing the process there. I suspect that the Swedish tar-kilns must be constructed of brick, or some sort of masonry, as the tar from thence is much clearer, better, and more free from extraneous matters than that of any other country. I have observed the tar from North Carolina to have frequently a quantity of sand in it, which is easily accounted for, from the soil in which the kilns are made; it would, in the careless way in which they take it out of the hole dug in a sandy soil, be very likely to be mixed with the sand. In the small cask, in which the turpentine is, I have sent a few small red deal knots from some timber that I have lately taken out of my warehouse, on some alterations being made; the timber from which they are taken has been in the warehouse ever since the summer of 1786, and yet, when these pieces are exposed to a moderate heat, the tar will be seen to exude from them.

Extracts

Extracts from Notes taken by Mr. WAY.

Thursday, April 12, 1792.

Arrived at Wilmington, North Carolina, about one P. M. Observed on the roads the pitch-pines prepared for extracting turpentine, which is done by cutting a hollow in the tree about six inches from the ground, and then taking the bark off from a space of about eighteen inches above it, from the sappy wood. The turpentine runs from April to October, and is caught by the hollow below. Some of the trees were cut on two sides, and only a strip of the bark left of about four inches in breadth on each of the other two sides, for conveyance of the sap necessary for the support of the tree. A Captain Cook, with whom I had been travelling, informed me that some trees would run six or seven years, and that every year the bark was cut away higher and higher, till the tree would run no longer, and I observed many that had done running, and they were in general stripped of the bark on two sides, as high as a man could reach, and some were dead from the operation; others did not look much the worse for it. I find the usual task is for one man to attend three thousand trees, which taken together would produce one hundred to one hundred and ten barrels of turpentine.

April 15, 1792.

On my return from Wilmington to Cowen's tavern, distant about sixteen miles from thence, I was informed that the master of the house had been a superintendant of negroes, who collected turpentine. I found the information I had before received was not perfectly correct; he told me he attended to six slaves for a year for

 a planter,

[redacted]

a planter, and between the 1st of April and the 1st of September they made six hundred barrels of turpentine. The cutting the trees for the purpose of collecting is called boxing them, and it is reckoned a good day's work to box sixty in a day; the trees will not run longer than four years, and it is necessary to take off a thin piece of the wood about once a week, and also as often as it rains, as that stops the trees running. While in North Carolina, I was particular in my inquiries respecting the making tar and pitch, and I saw several tar-kilns. They have two sorts of wood that they make it from, both of which are the pitch-pine; the sort from which most of it is made are old trees which have fallen down in the woods, and the sap rotted off, and is what they call light-wood, not from the weight of it, as it is very heavy, but from its combustible nature, as it will light with a candle, and a piece of it thrown into the fire will give light enough to read and write by; all the pitch-pine will not become light-wood; the people concerned in making tar know it from the appearance of the turpentine in the grain of the wood. The other sort of wood which is used, after the trees which have been boxed for turpentine have done running, they split off the faces over which the turpentine has run, and of this wood is made what is called green-tar, being made from green-wood instead of dry. When a sufficient quantity of wood is got together, the first step is to fix a stake in the ground, to which they fasten a string, and from the stake, as a centre, they describe a circle on the ground according to the size they wish to have the kiln; they consider that one, twenty feet in diameter and fourteen feet high, should produce them two hundred barrels of tar; they then dig out all the earth a spit deep, shelv-

ing

ing inwards within the circle, and sloping to the centre; the earth taken out is thrown up in a bank about one foot and a half high round the edge of the circle; they next get a pine that will split strait, of a sufficient length to reach from the centre of the circle someway beyond the bank; this pine is split through the middle, and both parts are then hollowed out, after which they are put together, and sunk in such a way, that one end which is placed in the centre of the circle is higher than that end which comes without the bank, where a hole is dug in the ground for the tar to run into, and whence the tar is taken up and barrelled as it runs from the kiln. After the kiln is marked out, they bring the wood, ready split up, in small billets, rather smaller than are generally used for the fires in England, and it is then packed as close as possible, with the end inwards, sloping towards the middle, and the middle is filled up with small wood and the knots of trees, which last have more tar in them than any other part of the wood; the kiln is built in such a way, that at twelve or fourteen feet high it will overhang two or three feet, and it appears quite compact and solid. After the whole of the wood is piled on, they get a parcel of small logs, and then place a line of turf, then another line of logs, and so on alternately all the way up, and the top they cover with two or three thicknesses of turf. After the whole is covered in this way, they take out a turf in ten or a dozen different places round the top, at each of which they light it, and it then burns downwards till the whole of the tar is melted out; and if it burns too fast they stop some of the holes, and if not fast enough they open others, all of which the tar-burner, from practice, is able to judge of. When it begins to run slow, if it is near where charcoal is

is wanted, they fill up all the holes, and watch it to prevent the fire breaking out any where till the whole is charred; the charcoal is worth two-pence or three-pence, British sterling, *per* bushel. It will take six or eight days to burn a tar-kiln; in some places they burn it at such a distance from the shipping that they have very far to roll it, and even then sell it at from 3s. 6d. to 4s. British sterling, *per* barrel, sometimes taking the whole out in goods, but never less than half the amount in goods, from all which it will be reasonably supposed that tar-burning in that country is but a bad trade, as it must be a good hand to make more than at the rate of a barrel a day; the barrels cost the burner about 1s. 3d. British sterling, each; the tar-makers are in general very poor, except here and there one that has an opportunity of making it near the water-side. Pitch is made by either boiling the tar till it comes to a proper thickness, or else by burning it; the latter is done by digging a hole in the ground, and lining it with brick, it is then filled with tar, and they set fire to it, and allow it to burn till they judge it has burnt enough, which is known by dipping a stick into it, and letting it cool; when burnt enough they put a cover over it, which stops it close, and puts out the fire. Five barrels of green tar will make two of pitch; and it will take two barrels of other tar to make one of pitch.

N. B.—The foregoing observations respecting tar and pitch, are copied from a memorandum made by me at Suffolk, in Virginia, on the borders of North Carolina, April 23, 1752, and are the result of the inquiries and observations I made on the subject whilst in Carolina.

Wilmington,

Wilmington, N. C. April 15, 1792.

In conversation with a Mr. Hogg, who had been settled there, and at Fayette-ville before the War, I learnt that pitch-pine timber growing on the sands was the best, and that it was reckoned to be better if cut in the winter before the sap rises in the tree.

It affords me much pleasure to learn that my communication, on the extraction of turpentine from the Scotch fir, has been thought worthy of the consideration of the Society; and it will be highly gratifying to me, if it should induce persons who have considerable plantations to try it on such a scale as to ascertain to what extent it might prove beneficial in this country. The experiment should be tried on trees so situated as to be conveniently examined every day, and the turpentine collected in the hollows removed as often as possible to prevent its being injured, or wasted by the rain. I think, that during the American war, some importations of turpentine were made from Russia and Sweden, and if so, it must have been extracted from what we call the Scotch fir in a colder climate than this. The article called Venice turpentine, which is brought from Carinthia and Carniola, is extracted there from the larch tree; and it might probably answer to try to produce it from the larch trees grown in Great Britain, in the same way as I have collected the turpentine from the Scotch fir. Respecting the wood of the Scotch fir being injured, by the extraction of the turpentine from it, I should rather think that it would, on the contrary, be the better for it; as all those who use deals from Scotch fir, in this neighbourhood, complain that it is too full of turpentine to work well. The fact might be ascertained, by the

the piece of timber which I sent to the Society, as if it was wished to preserve that part in which the hollow is made, the back part, or nearly half of the tree might be sawn into boards without injury, and those boards might be compared with some from a tree taken down in the winter, from whence the turpentine has not been extracted; it must however be noted, that from the tree I have sent to the Society, the turpentine has only been running one year, whereas, in America, they collect the turpentine from the same tree for three or four succeeding years. It has been supposed and asserted that turpentine was only obtainable from the United States; but I have sufficient documents to prove, if required, that a very large quantity of it can be procured from East Florida; and, I well remember, that about the year 1782, several cargoes of turpentine were shipped in the River St. John's, for Britain; and though that country is at present in the hands of the Spaniards, no doubt, arrangements might be made with the Spanish Government for a supply of that necessary article from thence. It is my earnest wish, that through the medium of the Society of Arts, I may render any information that may be serviceable to the interest of the united Empire, and I will, with pleasure, furnish further communication on the products of Florida and its commerce, if desired by the Society.

I am convinced that tar might be produced from the refuse of firs of English growth to advantage, and that a much better article could be made from them in Britain, that any imported from America. The Scotch firs, in England, from being planted at greater distances from each other than they are naturally found abroad, have much larger knots, and greater numbers of them, than

than in Carolina, or the North of Europe, and would thererore produce more tar in proportion from their refuse wood than the trees of those countries.

The pitch-pine of Virginia, the Carolinas, Georgia, and the Floridas, grow to an immense size in what are there called pine-barrens, the soil of which is finer and whiter than the sand used as writing-sand in Great Britain, and the trees grow almost to the verge of high-water mark on the sea shores. I think it would answer a good purpose for the Society to encourage, by premiums, the extraction of turpentine from British firs.

J. H. Browne, Esq. of Weymouth, certified that he had witnessed the principal experiments made by Mr. Way, in extracting the turpentine from the Scotch firs. That the trees had been planted in 1771 or 1772, and that the wood, subsequent to the operation, had been minutely examined, and found not to be injured by the extraction of the turpentine. He added, that the season was uncommonly wet and unfavourable for the experiment.

Reference to the Engraving of Mr. H. B. WAY'S *Method of procuring Turpentine from Fir Trees.*

(See Plate III. Fig. 4.)

a, Represents the lower part of a fir tree, as growing in the earth; *b*, shows the part where a portion of the bark is taken off to assist the emission of the turpentine; *c*, is a hollow cut within the body of the tree, it is in the form of a basin at the lower part to receive the turpentine, which exudes into it from the pores of the tree: this basin is about six inches from the ground.

Remarks on the present Mode of budding and grafting Fruit Trees.

By Mr. JOHN WILMOT, *of Isleworth.*

From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

THE good old way of grafting and budding fruit trees, was to do this upon a stem or stock several feet in height; and it is by this mode of raising trees that we now see so many beautiful and flourishing orchards. But this will, I very much fear, be looked for in vain by those who are to come after us, if a stop is not speedily put to the method followed at present. They are grafted and budded upon stocks but a few inches high; and this practice, (although it certainly answers the purpose of promoting a quick supply of plants), if it be well considered, will be productive of the greatest mischief. The nurseryman in working the standard fruit tree from the bottom of the stock, is not only injuring the individual who plants, but does irreparable injury to the public. Trees thus worked, I am well assured, will, in the ordinary course of things, last but a very few years; and instead of continuing for half a century in health and vigour, will begin to decline and decay after a lapse of a very few years. This I conceive must be particularly the case with trees planted in a garden, where frequent manurings are continually adding to the soil, so that in a few years it becomes raised above the budded part. In this case the whole of the wild stock becomes buried, and it is by that means deprived of the genial influence of the sun and of the atmosphere; and being

being thus abridged of the nourishment and refreshings which nature intended for it, it begins to decline in vigour, and soon after decays and perishes. This I have frequently observed in my own experience, and hence it is that trees are continually decaying, and such frequent supplies of them are required.

It ought also to be considered, for it is in my opinion a matter of great importance, that by the practice I deprecate fruit trees are exposed to much greater danger through external injuries than they otherwise would be. It is notorious, that the bearing stem (especially of peaches, nectarines, and apricots) is much more tender, and therefore much more liable to be injured than the wild stock; and, if injured, is by no means so likely to be so soon and effectually healed. Every man of observation knows, that the wild stock will bear, without material injury, wounds and bruises, which would occasion to the other a rapid and incurable decline. As, therefore, by this new method, the whole, or almost the whole, of the stem of the tree is of this tender nature, and by the old method the whole of the stem was of the hardiest wild stock, it is evident that trees, as they are now raised, are exposed to perpetual injuries from the spade, cattle, insects, &c. which they would not be if the old method of working from the top were to be restored. Arguments need not, I conceive, be multiplied to prove, that nature in its wild state is much more able to bear injuries with impunity than it is in a state of cultivation, and that the latter often become a prey to gum, canker, &c. which produce a gradual decline, from causes which would do none, or a very trifling injury to the wild stock.

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Description of a Machine for threshing Corn.

By M. de MUSIGNY.

With an Engraving.

From the BIBLIOTHÉQUE PHISYCO-ECONOMIQUE.

I HAVE constructed a machine for threshing corn in the open air, which I believe to be nearly as complete as possible, as much from its simplicity, the quickness of its motion, and its cheapness; its cost does not exceed 86 franks.

Each turn of the cylinder is equal to thirty-two strokes of the flail. In running over a circle of 40 feet diameter the cylinder makes 20 turns, and produces the effect of 640 strokes of the flail. A horse that draws the machine at a moderate pace, can easily give it two turns *per* minute, and in half an hour can go sixty times round the circle; which is equal to 38,400 strokes of the flail, which are enough to thresh 30 sheaves in half an hour, and is nearly the work of two men in a barn. As there are twelve disposable hours in a fine day, by repeating this work from hour to hour, in which is included the time taken in spreading the sheaves, and in clearing away the straw and the grain, 360 sheaves may be threshed in one day. Or as it takes nearly five to make two measures of grain of 30 pound each, the result would be 120 measures *per* day, the extraction of which costs very little.

One man, two women, and one horse relieved every two hours, are more than enough to do all this work, which will cost no more than four franks *per* day, and the measures of grain at about ten deniers each, which is

is a great saving when compared with the work done in the usual manner, as two men can seldom thresh more than from 14 to 15 measures *per* day, the mean price of which is about 25 *cent. per* measure, which makes a difference on the same number of sheaves and a saving of 27 franks *per* day, without taking into the account, 1st. The advantage of having the power to thresh immediately after the harvest, and also of selling the grain for at least one franc *per* measure more. 2dly. The employment of women and children in the work, whose labour is one-third cheaper than men. 3dly. Avoiding the accidents to which it is exposed from being threshed by candle light. 4thly. Avoiding the loss occasioned by rats when the sheaves are left in the barn during winter. 5thly. The unappreciable advantage which this machine possesses of cleaning the spotted and black corn. 6thly. Of breaking the straw at will, and rendering it more proper for feeding horses.

Description of the Machine.

The post in the centre A, (Fig. 1. Plate IV.) should be six or seven inches in diameter, it is fixed three feet deep in the earth, in the centre of the threshing circle B B, and to render it more firm, there should be a mortise made in the end that is in the ground, into which a key may be put, in the form of a cross; the part above the ground to the piece of wood C, which serves to carry the horizontal pole or axle-tree D, should be two feet high; the other part should be one foot high and an inch and a half in diameter. At the top is an iron pin to hold the pole E, which serves to direct the horse. The axle-tree D, held at one end by the post A which is in the centre of the threshing place, and at the other by

[illegible]

The pole E, which serves to keep the cord clear of the [illegible] of the wheel, should be five feet long and [illegible] inches and a half in diameter, and be firmly fixed in the mortise that is made in the axle-tree: this pole ought to be of very light wood. The wheel F must be at least 6 feet in diameter, it is best to have it made very light with a circle of [illegible] in a single piece, and six wooden spokes [illegible] and firmly fixed in the middle. The end of the axle-tree [illegible], to which the cord G is attached, should be at least a foot long.

Two pins K K, that are fixed in the tree D, serve to hold the traces L L, which are of a determined length and guide the carriage M in the ring. The pole E that guides the horse should have several holes in it to lengthen or shorten the traces as convenient, so as to make the horse describe a circle one-third less than that in which the carriage moves, and to form a track at the distance of a foot from the threshing ring, so as not to spoil and crush the grain by treading on it. The horse should be fastened on by the bridle to one of the ends of the pole, which should be very light, that it may not hurt his mouth. The branches of the carriage N N, serving to contain the cylinder O, must be two inches thick, five feet long, about one foot wide in the part that carries the spindle, and a foot and a half where it is mortised, which should be large enough to admit a wedge on each side of the tenons, as much to give firmness to the

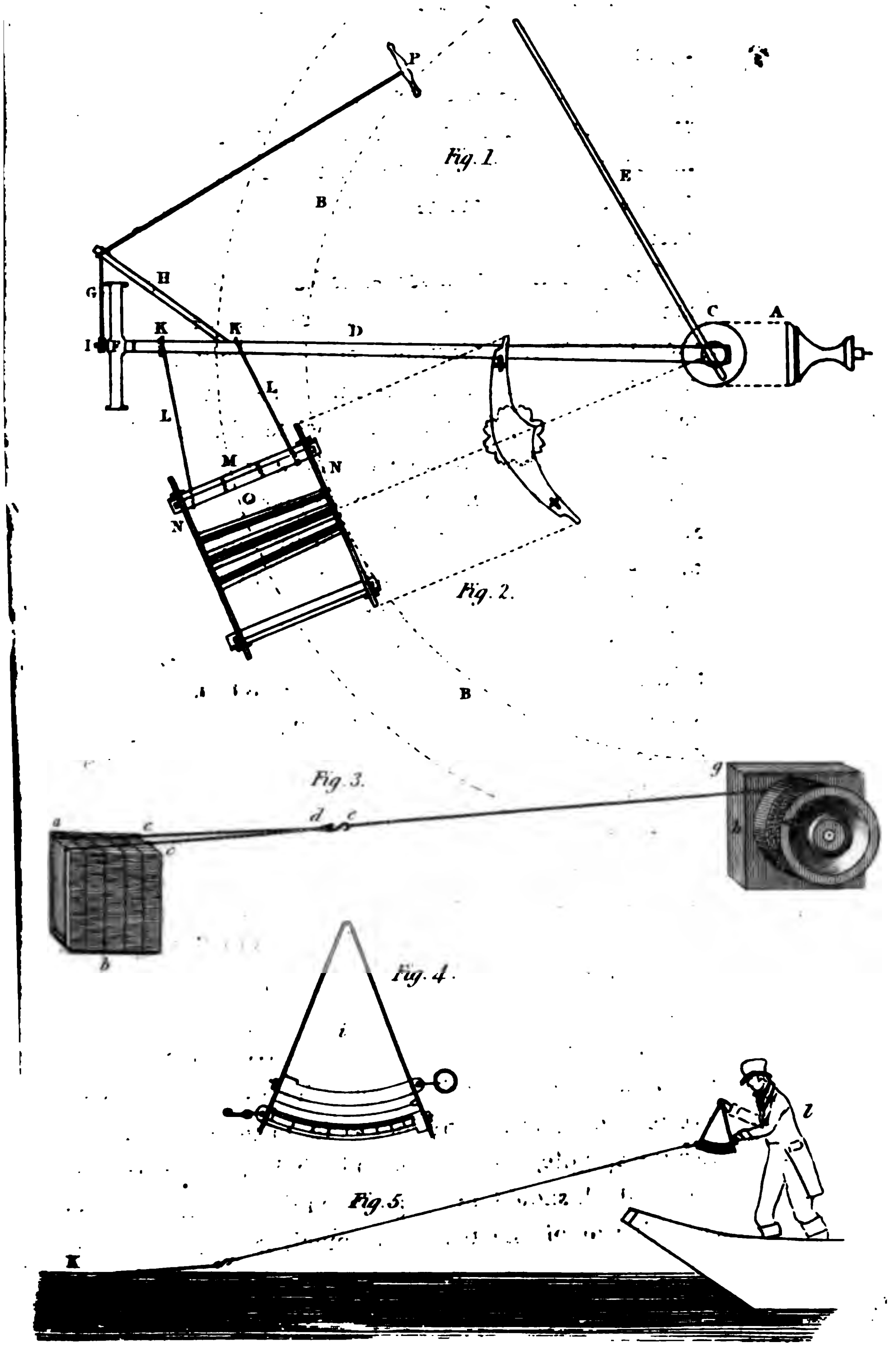
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.

e carriage as to facilitate the proper direction of the linder, by putting the wedge either on the outside or force, across the front of which the cords are fastened. he cylinder O should be at least four feet long, one et in diameter, and a little conical, that it may more sily describe a circle 40 feet in diameter.

Fig. 2 is a profile view of the carriage and the cylinder. The sheaves must be spread on the threshing ring as the tiles of a roof, by drawing back a portion of the es 7 or 8 inches from the first. When the cylinder as begun to bruise the straw, the sheaves must be rned with forks, the ears scattered about, taken away, nd lastly, the straw must be shaken with forks.

Description of a Machine called a Reumametre, for estimating and comparing the Velocity of the Currents of Rivers. By M. REIGNIER.

With an Engraving.

From the BIBLIOTHEQUE PHISYCO-ECONOMIQUE.

FROM the time of *Mariotét* until now, many persons f considerable merit have employed different methods r estimating the velocity and force of rivers, and these ethods more or less ingenious, appear to have left noing further to be desired. There is, therefore, some egree of temerity in proposing to add another to the umber, which may perhaps be thought to have less erit than any of them; yet as it is very simple, cheap, nd requires no calculation when being used, it may rove convenient to a great number of persons, who ay wish to establish mills or other buildings on rivers, here they are unacquainted with the velocity and force

of

of the current. This motive has determined me to propose my method, which has some analogy with employed by M. Gauthey, inspector-general of bridges and highways.

This able engineer was the first who made use of to find and compare the power of the currents of ri on a given surface. For this purpose he adapted to of the branches of the spring a slider of tinned iron a determinate size, on which the water acted b greater or less degree of pressure; and the little circ index, which remains fixed on the arc of division, dicates, when taken out of the water, the degree pressure the spring has sustained, and consequently exact force of the current into which the instrument been plunged. This method is something simila that employed by Michelotti, and described in his draulic experiments, but his apparatus is expensive tedious in putting together, whilst M. Gauthey's thod is much more simple and portable, is little o expense, and answers the same purposes.

I have observed, however, that in using it, the hand holds the stick to which the instrument is attached, involuntarily give an impulsive force to it, in additi that which is caused by the action of the fluid. inconvenience has led me to adopt another me which appears to me to be still more commodious accurate, and has the double advantage of giving tinctly both the velocity of the current and its e force on a given surface; and as these two operat serve to correct each other, they necessarily give tainty to the result.

Description.—This method consists, 1st. of a flo cork weighted, which is a cube of 10 centimetres,

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is so contrived as not to sink in the water any lower than the depth of its thickness.

2d. A small divider, like a pully turning on its axis, upon which is rolled a twist of silk of a determined length, in order to measure the space that the float runs over. (See Fig. 3, Plate IV.)

3d. A small dynanometer, Fig. 4, similar to that which I composed for ascertaining the tenacity of spun silk, cotton, and thread.

With this small apparatus which may be carried in the pocket, the action of any current may be ascertained with the utmost facility. The upper part of the cube carries a twist of silk, forming an acute angle like that of a paper kite, and to the point of the angle is hooked a red twist two metres long, tied to another twist of a green colour, which is ten metres long, and entirely rolled round the divider.

The other extremity of the green twist is hooked to the divider which is held in the hand.

I make use of twist of two colours, in order that the part which gives the space passed over by the float, may be distinguished from that which remains under water.

Silk twist is preferable to hemp, not only because it is more flexible and compact, but because it does not twist in the water nor retard the progress of the float. This may be ascertained by throwing into the water small balls of paper which float freely by the side of the cube, and the eye may remark a sufficient degree of uniformity in a course of ten metres, which is the given length.

Method of using the Apparatus.

The person that uses it must be in a boat anchored at the place where he wishes to ascertain the velocity and force of the stream.

When the boat is stopped, the float is thrown into the current, and the red twist is suffered to run out as far as the knot that fastens it to the green one, which, as before-mentioned, is entirely rolled round the divider; then two persons must observe it, one to attend to the seconds of a watch, and the instant the needle begins its revolutions, the other must let loose a click, that is fixed to the divider; the float continues its course, and the number of seconds that elapse during the experiment, indicate the velocity of the current, which has carried the float in a line ten metres in length.

This proceeding is not a new one, but the click which is added to the divider facilitates its use; it also facilitates the dividing of the twist for repeating the experiment, which it is best to do, two or three times, in order to be assured of its accuracy; however, the results have always been found nearly the same, at least with very little variation.

To find the strength of the current the loop of the twist must be released from the divider and hooked on to the dynamometer, then the spring of this instrument is more or less compressed according to the strength of the stream, and the number of degrees indicated by the index, express the maximum of the action of the water on a surface of 100 centimetres.

This action is not constantly the same, not only on account of the strength of the waves, but also from the natural running of the current, which is not always re-

gular;

gular; indeed in the most complete calm, without any apparent waves, the impulsive force has varied from one moment to another as much as from 6 to 8, and sometimes more.

But the velocity of the current has great power, as may be seen from an example taken from a course of experiments made at Paris, between the *Pont des arts* and the *Pont royal*, the 20th of July, 1809. When it was calm, and the Seine was a little below its mean height, it marked a metre and a half by the graduated scale of Pont Royal.

First situation ten yards from the shore.

	Velocity. Seconds.	Power. Hectogrammes.
1st. experiment	25	2 to 3
2d. ditto	26½	
3d. ditto	26	

Second situation in the middle of the current.

1st. experiment	14½	6 to 9
2d. ditto	14	
3d. ditto	14	

Third situation 15 yards from the shore, opposite the Rue des St. Peres.

1st. experiment	28	1 to 2
2d. ditto	28	
3d. ditto	28	

Although this example is not very extensive, it is enough to shew that the water at the sides of a river has very little velocity, and that the velocity in the middle of the current singularly augments the impulsive force, since the ten metres passed over in fourteen seconds had an effect of from 6 to 9 hectogrammes upon the float, whilst the same distance passed over in 28 seconds at the sides, gave only from one to two hectogrammes.

 On

On comparing our experiments with those of M. *Mariotte* made about 1666, in the same place, we found much similarity in the results.

This gentleman by means of little balls of wax, ballasted, which floated on the surface of the water, estimated the velocity of the Seine at its medium at 150 feet *per* minute, that is, 30 inches *per* second; but at the time our experiments were made, the Seine was but four feet six inches high, whereas, when M. Mariotte made his it was five feet, and we may conclude that the lapse of time, during a century and a half, has made no change in the course of the river in this part.

These experiments led us to compare the velocity of the Danube with that of the Seine. We find in the *Journal de Paris*, July 1809, a note from Baron Pakasi, which indicates that the velocity of the Danube at its mean height at Ebersdorff is four feet six inches *per* second, which is about double the rapidity of the Seine at Paris.

Explanation of the Engraving. Plate IV.

Fig. 3, *a*, a cork cube of 5 centimetres, bound round with pack-thread to consolidate it; *b*, a plate of lead attached to the cube to ballast it; *c c*, the knots from which the silk twist forms an acute angle at the point *d*; *e*, the hook at the end of the red twist which is two metres long, and tied to the green twist of ten metres in length, which is rolled round the divider *f*, for the purpose of measuring the velocity; *g*, a small block of hard wood, which serves as a base to the divider; in the centre of this block is fixed a small pin of polished steel, on which the divider turns freely; *h*, the end of the click which is confined by the thumb until the right moment to set it free.

Fig.

[redacted]

Fig. 4, *i*, a small dynamometer having an index above the arc of division, which indicates the maximum of the impulsions of the current.

Fig. 5, *k*, the cube plunged into the current of the river; *l*, the position of the observer in a boat, who holds the dynamometer in his hand, for the purpose of estimating the strength of the current after having measured its velocity.

Simplified Process for dying the Adrianople red by animal Matter, glutinous, serous, and caseous. *By* Jean Michel Hausmann.

From the Annales de Chimie.

HAVING already published several memoirs on dyeing the Adrianople red, it remains for me now to make known the rest of my labours on this subject: they have always been directed to the end of abridging and simplifying the manipulation, without losing any thing of the beauty and solidity of the colour; and I shall now give the result of my last experiments.

As the colour of any shade whatever is bright in proportion to the whiteness and cleanliness of the substance that receives it, I begin by bleaching artificially some skins of cotton or flax, by passing skeins them through a weak lessive of boilingcaustic alkali, and in a lessive very much diluted with water, of oxygenated muriate of potash with an excess of carbonate of alkali (commonly called *lessive de Javelle*). This operation when performed according to my method takes an hour. The skeins being afterwards washed and dried, I impregnate them with a solution of fine strong glue, made with eight parts of water. After they

they have been well and equally wrung and dried, I plunge them into a decoction of gall nuts, made with from twelve to sixteen parts of water.

It should be just so warm as to allow of the skeins being easily handled and kneaded without scalding the hands, in order that the glue may be well combined with the tanning substance of the gall nuts, and which forms on the surface of the skeins an animalised coat of a fine deep nankeen shade. Decoctions of sumac, the bark of oak and elder, may be used instead of the gall dye, and they produce other shades of nankeen. All these nankeen colours may be beautified and rendered infinitely stronger, by a long ebullition in bran-water, the bran being inclosed in a bag. I afterwards rince the skeins and dry them. During this operation the decoction of gall nuts must be essayed from time to time, by pouring into it a solution of strong glue; if the decoction is exhausted by the number of skeins that have been immersed in it, it will neither be thickened by the solution nor precipitate any animalised substance; it should then be strengthened or rather renewed. We may also conclude that the oxygenated muriate of potash is exhausted, when it has no longer an aqueous appearance; but when on pouring into it a few drops of weakened sulphuric acid, it disengages oxygenated muriatic acid, which is discoverable by its penetrating and suffocating smell, it is a proof that the lessive is still good.

There are besides other methods of animalising cotton as well as flax, and of favouring thus the adhesion of olive oil and alumina, for the better fixing of the colouring parts of the madder. The coatings I shall now

describe

describe are even more advantageous than the first of these for beauty and colour.

Equal parts of the white of eggs and water form an excellent coat on cotton and flax, which is impregnated with it, and then, having been previously well dried, plunged into boiling water, in order to coagulate and fix the albumine in it. This impregnation may be also effected with the white and yolk of eggs well mixed, without adding water to it; remembering every time to pass the skeins through boiling water when they have been well dried.

Milk will also form upon skeins of cotton and flax a fixed and solid coat of its caseous and serous parts; they will imbibe it three or four times successively, by observing to dry them each time, and after each drying, to plunge them into water slightly acidulated with sulphuric acid, in order to coagulate the milk that dries on the surface. The skeins will augment in weight at each immersion in the milk, which indubitably indicates the fixation of its substantial particles.

Although these different methods of forming a coat on skeins of cotton and flax, may in some degree be considered as a sort of animalisation, I propose nevertheless in a subsequent memoir, to confirm the experiments of M. A. Giobert, and to prove with him, that very fine reds may be obtained as solid as that of Adrianople, without having recourse to any animalisation whatever. Skeins of cotton and flax coated with the white of eggs or coagulated milk will furnish very fine and permanent nankeen colours; by leaving them plunged for a sufficient time in a very weak decoction of gall nuts, which would produce an increased degree of animalisation not at all disadvantageous to the process of making

making the Adrianople red: the nankeen colour may be rendered more or less reddish by adding to the decoction of gall nuts a greater or less quantity of madder.

It is not sufficient to have coated the skeins according to the methods I have given, in order to pass them afterwards through a mordant of alum; they must also be previously charged with a sufficient quantity of olive oil, which is indispensable for obtaining a fine and solid red; and as it cannot be exactly determined in small trials how much oil is necessary, I endeavour as nearly as possible to fill the skeins with a quarter of their own weight.

To this effect I dissolve an ounce and a half of carbonate of soda in crystals, in ninety-six ounces of pure water, which I afterwards pour by little and little, stirring it all the time, upon five ounces of olive oil. I plunge into this bath, which has a milky appearance, sixteen ounces of the cotton skeins, and knead them until the oil be almost entirely absorbed. I afterwards squeeze the cotton well, and when it is perfectly dry I treat it with the mordant as I shall describe below.

It is necessary to observe that the skeins that have been impregnated with fresh milk require much less oil, as the milk furnishes them with a good quantity of grease; and when the milk of cows or other animals is pretty thick and strongly charged with butter, the oil may be entirely dispensed with: the red obtained being neither less fine nor solid. The skeins that are coated with the white and yolk of eggs mixed together, have likewise no occasion for so great a quantity of oil, because the yolks of eggs naturally contain a great deal.

As it often happens that the oil employed is too pure, and does not contain enough of mucilage to form with the

the carbonate of soda, an artificial milk, this inconvenience is easily remedied by adding to the mixture a sufficient quantity of caustic alkaline lessive, not in excess however, as it would in that case form a soapy liquor, but merely enough to cause the mixture to form into a milky substance. If a lessive of caustic potash be used, it must be in a very small quantity; a little more is required if the lessive be of caustic soda, and made in the same proportions as the lessive of potash. For this latter, I generally take, when the carbonate of potash is of a good quality, one part to four parts of water, in which I have previously quenched half a part of good quick lime: half this quantity of lime is sufficient, when the caustic lessive is made with carbonate of soda in crystals.

The skeins having been charged with oil, and well dried, are then plunged into a mordant of acetite of alumine, which is obtained by dissolving in five parts of boiling water, one part of sulphate of alumine, very pure and free from iron, and one part of acetate of lead. This mordant must have been decanted and be very clear. The skeins imbibe it easily, and may be taken out at the end of a few minutes, to be squeezed and dried with the necessary precautions; but I have found that by having them plunged in the mordant two or three times during twenty-four hours, before they are pressed and dried, in a place sufficiently tempered and defended from damp air, the colours become infinitely more uniform, brilliant, and solid; especially if the aluminated skeins are allowed to remain spread open for two or three days before they are dyed. In strengthening the mordant by diminishing the quantity of water and augmenting the proportion of madder in the dyeing bath,

according to the strength of the mordant, the most lively red will be obtained; on the contrary, the shades will be paler and more of a rose-colour and require a less quantity of madder if the mordant be weakened.

The skeins that have been charged with the mordant and dried, take the water with much difficulty; they must therefore, before they are put into the bath of madder, be stirred quickly and regularly in pure water almost boiling, and afterwards carefully rinced in very clean running water, to free them from any saline substance that may still adhere to them, and prove prejudicial to the attraction of the colouring parts of the madder; for this substance only produces a lively and solid colour in proportion as its colouring parts are kept entirely free from any soluble substance, whether acid, alkaline, or neutro saline.

It was long unknown and even unsuspected that madder contains within itself a principle which tends to tarnish and lessen the solidity of the colour obtained from it; and it is for this reason that the dye is generally bad where it is not favoured by situation; that is, where the running or stagnant water that is used does not carry or hold in solution any carbonate of lime. The dyers at Augsbourg, Rouen, &c. among whom I reckoned myself, and who were favoured by the quality of the water they employ, attributed their success in their colours, to a quantity of superfluous drugs, of which they made a great mystery. It was only by removing from Robec at Rouen to Loglebach, near Colmar, that I discovered my error, and first thought of correcting the nature of the madder, by an addition of pulverised chalk, or an exact proportion of quick lime, not in excess, in order to decompose the sulphate of magnesia that

that the vegetation occasions in this colouring substance. It must therefore be considered as an incontestible principle, that it is absolutely impossible to procure fine and solid colours in the fabrication of printed calicoes, whatever mordants may be employed, unless they be entirely free from any soluble saline substance. The indispensable necessity of this addition of carbonate of lime, wherever the quality of the water is not favourable, may be confirmed, by cutting two bits off a piece of white calico, out of the printing-house, that have been treated with the mordants necessary for producing three shades of red and two of violet. Make use of the same water quite pure and free from carbonate of lime, to dye in madder these two bits of cloth in two different vessels, observing to put the pulverised chalk into one of them only. When this operation is completed, and the bits of cloth are taken out of the dye, a very surprising difference will be seen.

The colours or shades of one will be very lively and sufficiently charged, whilst the other, which had been treated without the addition of chalk, will be quite dull and pale, although treated with the same mordant and at the same time.

If the manufacturers of the Adrianople red cotton are able to make it without the addition of chalk, wherever they are situated, it is probably because the bullock's blood which they add to their madder dye, and without which they produce no fine and solid colours, contains some substance capable of decomposing the sulphate of magnesia, in the same manner as carbonate of lime or pure lime; or it may be that the sheep's dung, which they employ in the different manipulations of their animalisation, may contain a calcareous substance which

fixes on the cotton at the same time as the animal substance, and which is sufficient to attract and saturate the acid of the sulphate of magnesia contained in the madder.

It is besides essential that the cotton be dyed twice over, if it is wished to give to it all the beauty and solidity possible; the first time it should be left for two hours in the madder dye, and the heat should be so regulated that at the end of the first hour, it cannot be touched by the hand without burning; the fire should then be quite withdrawn, and during another hour the cotton should be constantly and regularly turned in the dye, after which it is washed in order to receive the dye a second time, the fire being managed as before, except that it must be continued at the end of the hour, in order to augment the heat of the bath in which the cotton must be moved and turned constantly during two hours.

When the preparatory operations have been made, two pounds of madder of the best quality, to one of spun cotton or flax, are sufficient for a perfect dye; that is to say, for each bath, half this quantity of madder, to which is added an ounce or an ounce and a half of pulverised chalk. I have constantly remarked that madder of the best quality always produced the most solid red, and the finest shades of scarlet.

When the cotton or flax has been thus twice dyed it must be washed, to make it boil for four, five, or six hours in bran water, the bran being enclosed in a bag; to which must be added, after the first hour of ebullition, half a pound of Marseilles soap to the weight of a hundred pounds of water. This last process which is called quickening, is that which in fact gives solidity to the

colour of the dye, which it will acquire in a greater or less degree, in proportion to the duration of the ebullition. I am convinced that generally all colours that will bear the ebullition, not excepting indigo and metallic oxyds, such as buff and its various shades, become more or less solid, in proportion to the degree of heat they are made to sustain, but it appears to me to be useless to employ in this operation of quickening, boilers almost hermetically closed, as it is a practice exposed to much danger.

The scarlet red may be easily changed to a rose red, by turning the cotton or flax for a longer or shorter time in a lessive of oxygenated muriate of potash, sufficiently diluted with water, until it has acquired the desired shade.

These shades will also furnish many other colours, by passing them through a dye of indigo, or treating them with more or less oxyd of iron, by means of a sulphate or nitrate of this metal, which may be either precipitated or fixed in them by means of a lessive of caustic potash diluted with water, to dye them also a third time in madder, or pass them through a bath or warm decoction of gall nuts or sumac. These decoctions, however, will not produce such lively colours as the madder dye. It must also be remarked that these changes in the shades are made with the most advantage before the operation of quickening.

The process of making Adrianople red, by these means of animalisation, may be perfectly adapted to spotted or any white subjects.

It is only necessary for this purpose to charge the carbonate of soda with a greater quantity of olive oil, to steep in it the cotton or linen cloth, and on taking the cloth

cloth out of this artificial milk, to pass it between two cylinders, in order to give it an equal pressure; this is what is done to printed calicoes of uniform grounds when treated with mordants. After the cloth has passed through the same operations as the skeins, it must be dried and rolled in order to fix in it as completely as possible the residue of the oxalic acid. Any other white article produced by this residue will always appear yellowish, when the cloth has received a shade of nankeen from the dyes of gall nuts, sumac, bark of oak or elder; this is not the case when it has been simply treated with a coat of the white of eggs: in every case the red is rendered much more agreeable to the eye, by pressing the cloth after it has been dyed; and passed through a lessive of oxygenated muriate of potash, diluted with water.

As I have drawn up this Memoir only for persons already acquainted with the process of dyeing, I thought it unnecessary to enter into minute details, which would besides be insufficient for those not already possessed of some preliminary knowledge in it. I address myself only to persons professing the art, in order that the processes I describe, and my intention of being useful, may not be frustrated by the attempts of ignorant persons. I should not even have published so soon my researches on the present subject, if my private occupations would have permitted me to give satisfactory replies to all the persons who have been desirous of consulting me upon it. Such persons, I think, cannot mistake the processes, as the theory and practice perfectly agree, and numerous experiments have confirmed them.

List

List of Patents for Inventions, &c.

(Continued from Vol. XVIII. Page 392.)

HENRY JAMES, of Birmingham, in the county of Warwick, for an improvement in the method or mode of navigating, forcing, towing, and hauling boats, barges, and other vessels upon canals, rivers, and other navigable waters, by means of mechanism or machinery to be worked by steam or any other suitable power. Dated March 26, 1811.

THOMAS DEAKIN, of St. John's-street, in the parish of St. Sepulchre Without, in the county of Middlesex, Stove-grate maker; for an improvement in kitchen-ranges and stoves, and the mode of setting the same. Dated April 1, 1811.

THOMAS WILLIAM STURGEON, of Howland-street, in the county of Middlesex, Esq.; for certain improvements on a micrometer. Dated April 1, 1811.

SAMUEL BENTHAM, of Hampstead, in the county of Middlesex, Civil Architect, and Engineer in the Navy; for a sure and economical mode of laying foundations, and in some cases of proceeding with the superstructure of works of stone or of brick, or other artificially composed materials, particularly applicable to the projection of wharfs and piers into deep water, to the construction of bridges, and to the formation or improvement of harbours, as well as to the erection of heavy buildings on bad ground. Dated April 2, 1811.

CORNELIUS VARLEY, of Junction-place, Paddington, in the county of Middlesex, Artist; for a telescope or optical instrument for viewing distant objects, and

and for other useful purposes; with a suitable table or stand for the same. Dated April 5, 1811.

John Blenkinsop, of Middleton, in the county of York, Coal Viewer; for certain mechanical means by which the conveyance of coals, minerals, and other articles is facilitated, and the expence attending the same is rendered less than heretofore. Dated April 10, 1811.

William Finch, of Birmingham, in the county of Warwick, Iron-master; for a method of making nails of wrought iron. Dated April 11, 1811.

John Taylor, of Greenwich, in the county of Kent, Esq.; for improvements in the construction of wheels for carriages of different descriptions. Dated April 11, 1811.

John Brown, of New Radford, near Nottingham, Lace-net Manufacturer; for a machine or machines for the manufacture of bobbin-lace or twist-net, similar to and resembling the Buckinghamshire lace-net and French lace-net, as made by the hand with bobbins on pillows. Dated April 24, 1811.

John Stockwell, of the city and county of Bristol; for certain improvements in the art or method of manufacturing shag-tobacco, whereby the stalks taken out of the leaf-tobacco, may be cut up into shag-tobacco without injuring the quality thereof. Dated April 24, 1811.

William Bundy, of Camden-town, in the county of Middlesex, Mathematical Instrument-maker; for an improvement on stringed musical instruments. Dated April 24, 1811.

John Bradley, of Colborn-hill, in the hamlet of Amblecoat, in that part of the parish of Okeswinford, which is in the county of Stafford, Iron-master; for a method of manufacturing gun skelps. Dated April 24, 1811.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CX. SECOND SERIES. July 1811.

Specification of the Patent granted to Sir ISAAC COFFIN, *Baronet, Vice Admiral of the Blue Squadron of his Majesty's Fleet; for a new Invention of a perpetual Oven for the Baking of all Kinds of Bread.*

Dated May 15, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Sir Isaac Coffin do hereby declare that the said invention of a perpetual oven for baking of all kinds of bread, consists of, and is constructed and used as follows: It is called a perpetual oven, because the operation of baking may be continued for any length of time uninterruptedly. It is best made of an oblong form, as shewn in the annexed drawing, (see Plate V. in which Fig. 1 is a longitudinal section, Figs. 2 cross sections, and Fig. 3 the external appearance), of sufficient length and breadth for the work contemplated, and is constructed of brick, stone, iron, or of any other proper and convenient material for the construction of ovens. A chamber A B, in which the bread,

&c. is baked, extends from end to end of the oven, and is open at both ends; the one in the annexed drawing intended for baking sea biscuits is twenty feet long and four feet wide, is ten inches in height at the end farthest from the grate or grates on which the fire is made, and decreases to six inches at the end where the fire-places are; but these dimensions vary with the nature of the article to be baked. The chamber is heated by means of flues C and D, one of which passes under its bottom and the other over its top. These flues proceed from two fire-places or grates E and F below, one of which is situate on each side of the same end of the oven, and are of such forms and dimensions as are in proportion to the heat required and the nature of the fuel used. In the oven represented in the annexed drawing where wood is intended to be used, the arches for the fire-places are five feet long, eighteen inches wide, two feet high, and are provided with iron doors and grates, and an ash-pit below. The heat ascends from one of these fire-places E, through proper openings, into a flue or space C, under the floor of the chamber to be heated, which extends the length and width of it, so that the heat spreads underneath the whole floor of the chamber, from the end where the fire-place is to the other where it or part of it ascends with the smoke into a flue G, carried immediately under the top of the oven, by which it is conveyed to a chimney at the end where the fire-places are, and there passes off. The heat from the other fire-place F ascends into a flue or space D, immediately above the ceiling or roof of the heated chamber, extending also the whole length and width of it, so that after heating the said upper floor or ceiling of the chamber, the smoke, &c. ascends, and returns along the

the same highest flue or passage G, to the chimney with the smoke, &c. of the other fire-place. Or this highest flue G may be divided longitudinally into two parts, and the one half serves to convey away the smoke, &c. of the fire-place E, and the other that part of the fire-place F. By means of this highest flue or returning chimney G, the upper exterior surface of the oven is always kept warm for seasoning the bread, &c. which may be laid upon it. For the more equal diffusion of the heat in the flues immediately below and above the heated chamber, pieces of cylindric or square bricks, stone, or metal, from two and a half to three inches in thickness are placed in them at regular distances from each other, which may serve likewise to support the floors above them. The floor and ceiling of the heated chamber may be of tiles made of fire-clay or of fire-stone, or of cast or sheet-iron, or of other metal, or of any material which stands fire and readily transmits heat; if of well-made tile, the thickness need not exceed one to one and a half inch, but should be thickest at the ends nearest the fires. The joints must be close and may be rebated and laid in cement, so as not to admit smoke from the under and upper flues. The floor of the heated chamber may be supported on props as already mentioned, or it may rest on transverse iron bars, which latter must at all event be used to support its ceiling or roof, placed at such distances that each tile may rest upon them. The bottom of the lower flue C is supported by an arch of bricks, or of whatever other material is used in the construction of the oven, which arch is of the same width as the heated chamber, and extends the whole length of the oven, and is open at both ends, leaving under it the passage H. Near each

end of the oven is a roller or cylinder I and K of cast-iron, or of wood cased with sheet-iron, of about three feet in diameter, and as long as the heated chamber is wide; the axis of which cylinders are supported upon frames of iron or wood as shewn in the drawing. Over these cylinders passes an endless web of wire cloth, iron, or other metal L L, of somewhat open mash and rather coarse and strong, of nearly the width of the heated chamber which it traverses near the floor, and returns below through the passage H between the two fire-places; it is kept from rubbing on the floor of the chamber by iron friction rollers of two to three inches diameter, and from six to twelve inches apart, lying across the chamber, and having their axis upon an iron frame. When this oven is used for baking, it is first brought to a sufficient heat by means of the fires and flues above described, the biscuits or bread is then placed on the endless web of wire-cloth at the end farthest from the fires, and by turning the cylinder or roller next the fire-place slowly, it passes on with the web into the heated chamber, and by properly proportioning the slowness of the motion to the degree of heat which experience will soon teach, it will come out at the end where the fire-places are sufficiently baked, and may then either be taken off or suffered to fall off. Fresh biscuits or bread must be continually laid on the wire-cloth as it enters, so that a regular and constant succession is kept up. A very light door of sheet-iron or other metal may be hung at each end of the chamber from the top, so as to prevent the escape of much heat, and not to interfere with the entrance and exit of the wire-cloth and substances to be baked. The ceiling of the heated chamber rises gradually from the end where the fire

fire is made to the opposite end where the bread enters, for the purpose of facilitating the issue of the steam from the bread or biscuit at the end at which they enter. Four to six inches in the whole length is a proper rise in the chamber of an oven of the dimensions of that above described, and referred to in the annexed drawing, but may admit of variation according to circumstances. Cord-wood is the best fuel to use upon the grates; but peat or coaks, or those kind of pit-coal which emit little smoke may also be used. Coals which generate much soot would too soon choak up the flues, and prevent the heat from penetrating the tiles. A variation in the construction of the oven is made as follows; a single fire-place is made at one end of the arch under the heated chamber, the flame and heat of which pass through a flue immediately under the floor of the chamber to the other end of the oven, where they ascend by perpendicular flues to another horizontal flue carried immediately above the ceiling or roof of the chamber, which returns to the end next to the fire, and there opens to the air by means of a small chimney on each side of the oven; and, as by this construction the endless web is precluded from passing under the chamber, it is turned upwards over a cylinder at each end, and passes back over the top of the oven. The bread, &c. is put in as before at the end farthest from the fire, and when it arrives at the end nearest the fire, is either taken off by hand or pushed off by sloping pieces of wood across the web, which slide into baskets at the sides. In smaller ovens the endless web may be dispensed with, and the wire-cloth stretched upon a light iron frame of the length of the oven, which with the bread, &c. placed upon it, is pushed in at the end

farthest

farthest from the fire, and gradually advanced to the other, at which it is as gradually withdrawn. By this mode of baking, time, fuel, and labour are saved, and other advantages are attained, for the bread, &c. when first put into the oven goes into the lowest heat, and regularly advances to a hotter situation as it dries and is better able to endure it; the drying is also facilitated by the escape of the steam at the end of the chamber where the bread enters, instead of being confined as in the common oven, and the bread or biscuit lying upon an open wire, leaves the heat free to act upon all parts of it. By this means the biscuit, &c. is sooner dried when it leaves the oven, than in the old mode, and will keep longer. The baker has it also in his power to roll the biscuit, &c. out of the oven the moment he discovers it is baked enough, and he may keep the oven regulated at the proper heat by means of thermometers, and a judicious management of the fires.

In witness whereof, &c.

Specification of the Patent granted to JAMES BELL, *of Fieldgate-street, Whitechapel, in the County of Middlesex, Sugar Refiner; for certain Improvements of refining Sugar, and of forming Sugar-loaves of a certain Description.* Dated May 17, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said James Bell do hereby describe my said invention as follows: My improvements in the manner of refining sugar will be best understood by first describing the present

Pl. V. Vol. XIX. Second Series.

Fig. 5.

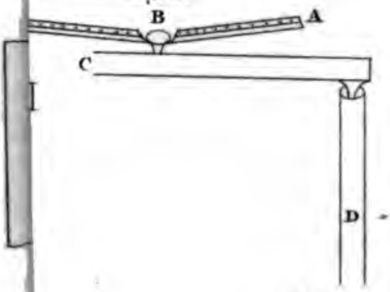


Fig. 3.

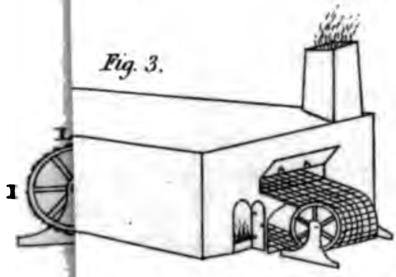
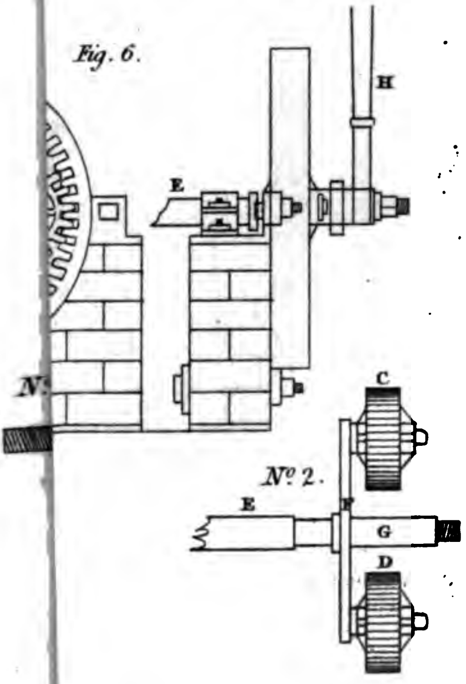


Fig. 6.



resent method in which certain parts of the process of re-ining sugar are carried on, and the objections to which this method is liable; according to the present methods, it is the practice of sugar refiners to place the moulds upon pots, both made of pottery, into which the syrup drops from the moulds containing the sugar. The objections to the use of pots for collecting the syrups may be classed under the following heads: First, the time and labour of the workmen in collecting the syrup from the numerous pots into large pots called gathering pots, and conveying the syrup in these large pots into the pans. Secondly, The difficulty of ascertaining the quantity and quality of the syrup obtained from each complement or class of sugars under process, and also the difficulty of catching the precise time when the moulds and pots ought to be reset, in order to keep separate the different qualities of syrup obtainable from each mould. Thirdly, The tendency of the syrup to turn acid, by remaining in the pots in the upper parts of the sugar house. Fourthly, The time and labour of the workmen in scraping the pots previously to taking stock; and the waste of sugar occasioned by what remains, notwithstanding, in parts of the pots where it cannot be scraped off, and also by the splashing of the syrup on the outsides of the pots in consequence of their being frequently emptied, which syrup in a great measure becomes useless from its turning acid and being mixed with dirt. Fifthly, The expense of new pots to replace the breakage of the old ones, and the waste and loss of syrup which these new pots absorb. Sixthly, The loss in the space of the floors occupied by the gathering-pots, and the trouble and inconvenience of carrying them when full to the place where they are to be emptied

[redacted]

[illegible] These [illegible] the use o[illegible] [illegible] more [illegible] my improvemen[illegible] [illegible] refining sugar, which is t[illegible] [illegible] by making trunks or gutter[illegible] under [illegible] to receive syru[illegible] [illegible] cisterns, fro[illegible] whence it may be again conveyed into the pans. The[illegible] trunks or gutters may be made of convenient length[illegible] with holes in the upper side of them, in which (at par- ticular instances, suitable to the different sizes of th[illegible] moulds containing the sugar under process) the tips o[illegible] points of the moulds may be inserted or set; and th[illegible] upper side of all of these trunks or gutters should be s[illegible] made, as that it may be taken off for the purpose o[illegible] cleaning the inside of them. These trunks or gutter[illegible] and also the trunks, gutters, and pipes afterwards men- tioned, may be formed of any substance which will no[illegible] injure, such as wood, pottery, artificial stone, or meta[illegible] or they may be composed partly of one such substanc[illegible] and partly of another. They should be placed in a[illegible] inclining or slanting direction, with an inclination suf[illegible] ficient to make the syrup run into another gutter place[illegible] under their lower extremity, so as to conduct the syru[illegible] to pipes communicating with cisterns appropriated t[illegible] different syrups, which may be conveyed with pleasur[illegible] from these cisterns into the pans by means of pipes an[illegible] [illegible]. These main gutters may be placed abov[illegible] or under the floor as convenience may require; but if placed under the floor, the syrup running from th[illegible] trunks or gutters on which the moulds are placed, mu[illegible] be conducted by pipes or funnels into the lower or mai[illegible] gutter, from whence it may be conducted into the pip[illegible] communicating with the cisterns. In order that th[illegible]

improv[illegible]

improvement may be better understood, a drawing of it is annexed, and in describing the parts of this drawing, the above-mentioned trunks or gutters upon which the moulds are to be placed to receive the syrups should be called the collecting gutters, and the trunks or gutters into which the syrups pass from the former into the latter shall be called the main or conducting gutters, which convey the syrup into the pipes, by which it is conveyed into the cisterns.

In the annexed drawing, A, Figs. 4 and 5 (Plate V.) represents the collecting trunks; B the funnels; C the main or conducting gutters which convey the syrup into the pipes, by which it is to be conveyed into the cisterns D. These pipes should be made as the pipes used in sugar houses are at present, so as to be taken to pieces for the purpose of being cleaned, and also, so that they may be shifted from place to place, and made to pass through holes in the floors, as situations may require for conducting the syrups into the cisterns made to receive them, which cisterns do not require any particular description, and may be made of any material of which cisterns are generally formed; but in order the more easily to keep separate the different qualities of syrup, each cistern should be divided into compartments to receive the different syrups, the bottom or lower part of each of which compartments should be provided with a pipe and stop-cock to convey the syrup in it at pleasure into the pans. The cisterns should be placed in a cool situation, and by inspecting the syrups running into them from the pipes, their quality may be readily ascertained; for which purpose the lower extremity of the pipes should be so placed, as that the syrup may be seen running or dropping from them into the cistern; and the lower ex-

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tremity of these pipes being also so constructed, as the syrup may be conveyed into any compartment in the cistern at pleasure. Syrups of different qualities may be thus easily separated and kept separate. The quantity of syrup thus brought into each compartment can also at all times be accurately ascertained by an index or scale marked upon it, or by a guage which may be placed in it.

The above appears to me to exhaust the description of my improvement in the manner of refining sugar, which supersedes the use of pots. With regard to that part of my improvement which relates to the manner of forming sugar-loaves of a particular description; it also will be best understood by first describing the manner of forming sugar-loaves at present, so far as relates to my improvement; these are at present formed of a conic shape. Very considerable attention has been paid to please the eye in the form given to the loaves, and the most taper form has been preferred; but sugar-loaves have hitherto been formed only with plain or smooth coats or sides, that is plain or smooth on the outside. Now my invention in this respect consists in making the loaves, whatever may be their size, fluted on the outside, or with such stripes, figures, ornaments, or devices, as fancy may suggest. In order to understand how this is to be done, it is necessary to distinguish between different sorts of sugar-loaves; in regard to such loaves, the largest of which are called lumps, all of them being formed in pottery moulds, the loaves may be made of any fluted or striped appearance of the outside by the manufacturer giving to the mould in the inside the form meant to be impressed upon the outside of the loaves; and the loaves so fluted or striped may be taken when duly refined

refined or manufactured out of the mould, in the same manner that the plain ones are at present. This is one way in which a fluted or striped form may be given to sugar-loaves while under process; but this may be done in another manner as follows: supposing the loaves to be formed in a plain pottery mould as at present, when they are taken out of the mould in a soft state, before being put into the stove, let them be forced or pressed into a metal mould nearly of the same size or shape, fluted or striped in the inside, or having described in the inside such figures, ornaments, or devices as are meant to be represented or impressed on the outside of the sugar-loaf. If the outside of the sugar-loaf is meant only to be fluted or striped, or to have devices running in straight lines from the top to the bottom of the cone, the metal mould may be used whole and entire, as metal moulds for forming powdered sugar, afterwards mentioned, are at present, and the sugar-loaf, after having received the impression meant to be given to it, can be taken out of the mould, as plain loaves are taken out of the plain metal moulds already in use. But if it is meant to have figures or devices running transversely or otherwise than from top to bottom of the cone upon the sugar-loaf, the metal mould must be made in two pieces with douls, that is corresponding pivots and holes, or with clasps and hinges, so that it may be kept together or shut until the sugar-loaf shall have received the impression meant to be given to it, and afterwards taken asunder or opened, so that the sugar-loaf may be taken out. Sugar-loaves have already received a plain form by means of a metal mould, and the practice has generally been to take refined sugar-loaves or lumps after having been framed in pottery moulds, and while yet in a soft

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or damp state, and before they are stove-dried, to shave, cut, or bruise them down into a powder, which is compressed into metal moulds, and being therein forced down by means of a heavy hammer, it receives the form of the mould, from whence it is afterwards taken out in a hardish state and afterwards dried. The chief difference therefore in this case between my method and that now followed, consists in the difference of the mould. Mine is fluted or striped, or has figures, ornaments, or devices in the inside of it, whereas the mould used at present is plain.

No particular description is necessary for making the moulds, as they can be made fluted or striped, or with any such figures, ornaments, or devices as a sugar refiner may desire, by a workman who can make them plain, assisted by an artificer accustomed to cut and carve figures, devices, and ornaments on metals; but in order to have the fluting or stripes, or the figures, ornaments, or devices cut, engraved, or otherwise made and polished in the inside, the mould should be made in two pieces which can afterwards be soldered together, or the two pieces may be joined together by douls or by hinges and clasps, so as to be taken asunder or opened or shut at pleasure. The bottom of the sugar-loaf has also been made plain, but by my method any mark, letter, or name, ornament, figure or device, which the sugar refiner may choose, may be impressed upon it, either by means of a dye or plate, or piece of metal, having designed, engraved, or cut thereon the particular letter, name, ornament, figure, or device meant to be represented on the bottom of the sugar-loaf.

In witness whereof, &c.

Specificatio

Specification of the Patent granted to WILLIAM DOUGHTY, *of Birmingham, in the County of Warwick, Engineer; for a Method of combining Wheels for gaining mechanical Power.*

Dated February 12, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Doughty do hereby declare that my said new invention or method of combining wheels, consists in the following description: A, Fig. 6, (Plate V.) is an immoveable or fixed wheel; B is the wheel of action or first mover; C and D are revolving wheels working in B and A on loose centers or studs, which are screwed into the arm F; section No. 2; which arm is pinned or wedged on the shaft or axle E; the wheel B, has an arm or crank pinned on at I, section No. 3; by which it receives its impulse and works loose on the axle at G; and when in motion, forces the wheels C and D round, pressing D downwards and C upwards, and by this means removes or reduces the friction at E. By this proportion of the diameters A, B, C, and D, the power obtained is four to one, the wheel B going four revolutions to the axis E one. According to the power required, must be the diameters of the wheels; that is to say, to obtain the power of seven, the wheel B must be to A as six to one; and the wheels C and D in proportion to the space between A and B. Fig. 7 is for gaining velocity; A is an immoveable or fixed wheel with the teeth inwards; B is a wheel pinned or wedged on the axle

axle E, section No. 4; C and D are wheels working loose on centers screwed into the arm F, section No. 5, and are the first movers in this motion; D pressing downwards and C upwards, receiving their velocity from A, causing the wheel B, that is fixed on the shaft or axle E, to make four revolutions for the arm or crank one; this arm working loose on the axle E, at G; these motions or methods of working wheels enables you to obtain on its own axis any power or velocity required in proportioning your wheels accordingly, and is applicable to all engines, woollen, cotton, flax, hemp, threshing, and other machinery requiring circular motion; as also to mills, lathes, grindstones, windlasses, cranes, &c.; and by increasing the number of the wheels C and D in proportion to the strands, it is applicable for twine, rope, and cable machines, and other useful purposes; by this method the friction or machinery is considerably reduced, is rendered more portable and durable, less liable to accidents and less expensive.

In witness whereof, &c.

Specification of the Patent granted to JOHN BRADLEY, *of Coalburn-hill, in that Part of the Parish of Old Swinford, that lies in the County of Stafford, Iron-master; for a Method of manufacturing Gun Skelps.*

Dated April 24, 1811.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Bradley do hereby declare that my said invention is described in manner following; that is to say: The principle of my invention consists in the manu-

manufacturing of iron skelps (for the making of barrels for fire-arms), wholly and entirely by rollers instead of by forge hammers, which is the present general mode of manufacturing them.

And for this purpose, I take a pair of rollers of about fifteen inches diameter, which have been previously drilled and turned with the number of grooves (*viz.* four) requisite for manufacturing the sort of skelps required, and fix them in such a frame as is generally used in the working of rollers. Then I take a bar of iron cut to the proper weight, well known to the manufacturers of these articles (four ounces being allowed for waste), as wide as the breech-end of the skelp required, which I heat in an air furnace, to what is called a good welding heat (which is much hotter than the degree of heat commonly termed a red heat, generally used in making skelps in any other mode), and put it in the first instance through a groove in the roller three quarters of an inch wide, but which is at its entrance four inches in depth or height, from which it gradually lessens to the orifice where the iron leaves the rollers to two inches and a half, so that by this its first passage through the rollers, the iron is made twelve inches long and four inches wide at the breech, from which it gradually diminishes to two inches and a half at the muzzle. In other words the groove is cut or hollowed out in such a manner, as to give out or produce the bar or piece of iron four inches wide at one end, and by a gradual diminution two inches and a half at the other. The bar or piece of iron must now at the same heat be passed successively through three other grooves, formed similar to each other in principle, but cut in such manner, as after being passed through each of them gradually to bring the skelp

skelp to its proper form and size. These grooves are turned and chipped in such a manner as to make the bar or piece of iron after it has passed through them, and is become a skelp, four inches and one-eighth wide at the breech, and three-eighths of an inch thick, and three inches and one-eighth wide, and barely three-sixteenths of an inch thick at the other end. The edges are made thinner than the middle, which is left, as the welders term it, thick on the back, and being in every respect of the proper dimension for finished skelps, they are thus produced by the rollers only, without the aid of hammers, shears, cutters, or any other machinery or implement whatever.

The advantages of this method of manufacturing skelps are, that the barrels made from them turn very sound and clear, and are free from greys or flaws; when welded they grind and bore much clearer than hammered ones; the pure metallic particles, being compressed by the rollers both edge-ways and flat-ways at the same time, cohere more closely together; nor are the skelps liable to reins or flaws as those are which are edged up in a less hot state under a forge hammer, and owing as I conceive to the rapidity with which skelps made in this mode are rolled under a high degree of heat, by which the fibres of the iron are closely united; and not reined and beat hollow as is the case with hammered ones. Barrels from these skelps will stand a much stronger proof than those made from forged ones.

In witness whereof, &c.

Improved Mathematical Dividing Engine. Invented by Mr. J. Allan, *of Blewit's-buildings, Fetter-lane.*

With a Plate.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Gold Medal of the Society was voted to Mr. Allan *for his Improvements.*

I BEG leave to send, for the inspection of the Society, a model of my improvements on the mathematical dividing engine, which I have lately made, containing that part which differs in principle from those made by the late Mr. Ramsden and others; the drawings or engravings of which are, I suppose, in the Society's possession. I therefore am of opinion the Society will think that the wooden wheel I have sent with the moveable ring on its edge, will be sufficient to demonstrate its good effect in correcting the teeth or rack where the screw acts. You will please to observe, that it is cut by a screw-cutter, and it is required to go many times round the engine before the teeth are full. To effect this, I reversed the moveable ring not less than twenty times, so that I have not the least doubt of the one ring having corrected the other to a degree of perfection which had not hitherto been obtained in engines.

This simple, easy, and correct way of making engines, may be applied with great advantage to circular instruments for the purpose of astronomy and land-surveying.

My engine is of bell-metal, thirty inches in diameter. I turned a brass ring about three-sixteenths of an inch thick,

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thick, and fitted in on the underside of the above bell-metal wheel, which I made fast by twenty-four rivets; I then fixed in the axis, and turned the wheel and ring together on the lathe, as near as possible to the required shape on its own axis. This being done, and having mounted it on its own stand, where it now acts, I fixed a tool, with an adjustment to turn the edge of the bell-metal wheel where the uppermost or moveable ring of the same thickness as the other is fitted on; for if the circle, where the moveable ring fits the bell-metal, is not turned as true as possible, (which cannot be done properly by any other means than by a fixed tool) the moveable ring will not reverse correctly. When this was done, I fitted on the moveable ring. I then divided the lower under ring into twenty-four parts, for the screws which keep the rings together. I also divided it into four parts for the steady pins; the holes of which I made by an upright drill, fixed and adjusted for the purpose. I then cut two opposite divisions, in order to reverse the uppermost ring correctly, which were my guide in broaching for my steady pins, and which I did with a broach to a stop fixed on it. In broaching, I reversed the moveable ring many times, taking care at the same time that my opposite divisions were correct.

My first idea was to have two wheels or circles, acting on the same centre, so as to constitute a double edge, to afford me an opportunity to reverse in the act of cutting the rack or teeth; but I thought the method in which I have done it would with care be equally correct. Either of the methods come to the same point, and I preferred the way I have employed, thinking it the least expensive. By this self-correcting method, instruments may be made for astronomical purposes, racked and divided

on

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on their own centre, and if carefully done would border on perfection itself; consequently I consider it to be the greatest improvement ever made in the art of dividing. I call it self-correcting; because every time it is reversed in cutting the teeth, the screw has a fresh opportunity to correct errors insensible to the eye.

I have well considered the subject, and think that a circle of twelve inches diameter, made on this principle, would measure angles equally, if not more accurately than astronomical instruments divided by engines, or by any other methods hitherto used by instruments of any size. It is, therefore, my opinion, that the supposed necessity of making very large circles, for the sake of obtaining correct divisions, will be done away.

CERTIFICATES.

After a close consideration of Mr. Allan's improvement in dividing engines, (I mean his mode of racking the teeth only,) when combined with the methods at this time known and practised, I look upon it as an important discovery; it is a plan that, in my opinion, will admit of a great degree of accuracy, approaching nearly to perfection itself, particularly in circles of small radius, but not quite so applicable in large machines for the purpose of dividing. JOHN STANCLIFFE.

Little Mary-le-Bone-street, Dec. 15, 1809.

The method Mr. Allan has taken to produce a perfect equal racking, for the constructing an accurate dividing engine, is the greatest advance towards perfection that has been communicated to the public within my knowledge,

ledge, and I believe it to be a method never before practised in this country. It is applicable to the construction of machines of any dimensions, that mathematical or nautical instruments can be graduated by.

It is my belief, that the greater number of the machines now in use are far short of the perfection they are reputed to have. M. Berge.

Piccadilly, Jan. 8, 1810.

Reference to the Drawing of Mr. Allan's *Improvement on the Dividing Engine of Ramsden.*

The dividing engine invented by Mr. Jesse Ramsden, and for which he received the reward of the Board of Longitude, in the year 1775, is minutely explained in a quarto pamphlet, published by order of the Commissioners of Longitude; also, in the article *Engine*, in Dr. Rees's New Cyclopædia, as well as some other works of a similar nature; it therefore becomes unnecessary for the Society to give any more of Mr. Allan's engine in their drawings than is explanatory of the improvement, the engine being used in the same manner as Ramsden's; this part is the great circle upon which the arch to be divided is placed, and the circle turned about a determinate quantity at each division, by means of a screw, whose threads engage fine teeth, cut around the periphery of the circle. The improvement by Mr. Allan consists in the method of cutting or racking these teeth, to ensure their being perfectly of equal size in all parts of the circle.

The plan, Fig. 1, (Plate VI.) represents the upper surface of a bell-metal circle mounted upon an axis A, Fig. 2, and its surface made truly plane, and perpendicular

cular to the axis; the section shews the figure of the axis, and the central ring B to give the greatest strength to the circle; C is a section of a portion of the frame of the engine; and D a socket into which the axis A is fitted; the circumference of the large circle is turned to such a figure as to receive a ring of brass *a*, Fig. 3, which is united firmly to it by a number of pins, one of which is shewn in the figure. Upon this ring a second *b* is placed, the two making the same thickness as the circle. The inside of the ring *b*, and the outide of the bell-metal circle, are fitted to each other with the utmost accuracy, and great care taken to turn the said truly fitting concentric with the axis of the circle; the brass rings *a* and *b* are held together by twenty-four screws, as shewn in the plan; and a groove, corresponding to the curvature of the screw which moves the circle, is turned in the outside of the two. In this state the racking of the teeth is performed by a screw, similar to that afterwards used to turn the circle to its divisions, but notched across the threads so that it cuts like a saw when pressed against the circle and turned round, and removes the metal from the spaces between the teeth, which are by this means formed around the edge of the circle. When this has been performed all round, two fine lines are drawn across the brass and bell-metal circles, diametrically opposite each other; the twenty-four screws are then withdrawn, and the upper brass ring turned exactly half round, which is determined by the lines before mentioned; and by this means the teeth of the circle are divided into two thicknesses, and being put together again in opposite directions, if any error arose in racking the teeth, it would be shewn by the upper and lower halves of the teeth, not coinciding when reversed, and

and by racking them while reversed the screw would cut away the inequalities, and make all the teeth of the same size and distance from each other; this reversing the teeth is performed several times, till the teeth are brought to a perfect equality in all parts of the circle; four steady pins are accurately fitted into the two rings to hold them together in any of the positions in which they have been racked together, and it is upon these the dependence is placed for the coincidence of the teeth, the twenty-four screws being merely to hold them fast together, and fitted rather loosely in their holes, that they may not strain the steady pins.

On the Cultivation of Horseradish. By Mr. JOSEPH KNIGHT, *F. H. S.*

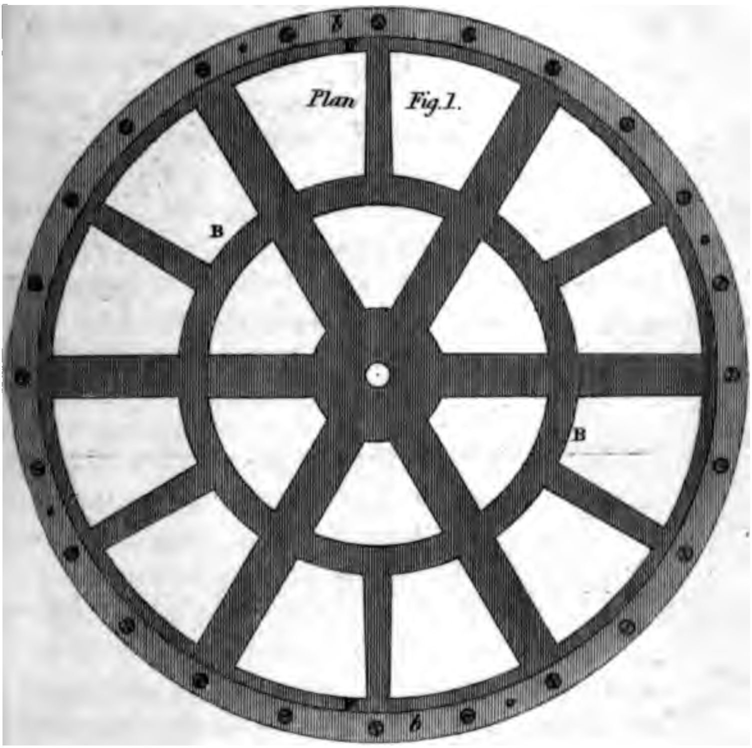
From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

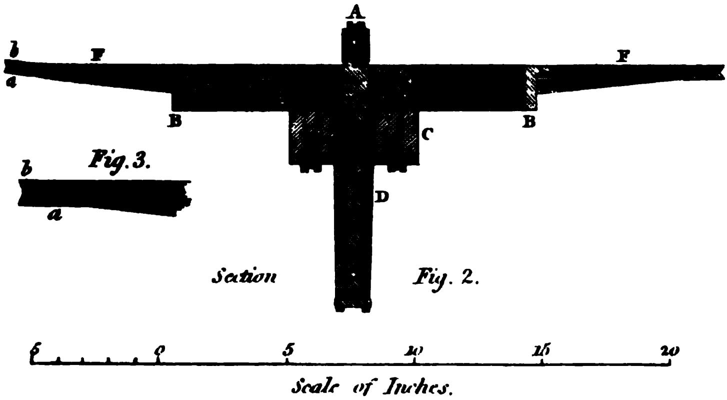
THE cultivation of this wholesome and useful vegetable hitherto appears to have been much neglected. Being a plant that thrives in almost all soils and situations to greater or less perfection, it has not demanded the particular attention of gardeners, nor have I the most favourable opportunity of cultivating it, although I now venture to lay the following account before the Horticultural Society.

Horseradish thrives best in deep, soft, sandy loam, that is not very dry in summer, nor inundated in winter: the situation must be open.

Trench the ground three feet deep, and if fresh grass-land, it should lie twelve months to pulverise, and will be improved by growing a crop of potatoes the first summer.

Pl. VI. Vol. XIX. Second Series.





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mer. In the following February procure your sets, in the choice of which take the strongest crowns or leading buds from old plants, cutting them about two inches long: when a sufficient quantity is thus prepared, proceed to mark out the ground in four-feet beds and one-foot alleys, by strong durable oak stakes, then take from the first bed nine inches of the top soil, laying it upon the adjoining bed; after which take out an opening at one end of the bed, in the common way of trenching, fifteen inches deep from the present surface; then level the bottom, upon which plant a row of sets across the bed, at nine inches apart each way, with their crowns upright; afterwards dig the next trench the same width and depth, turning the earth into the first trench over the row of sets: thus proceeding, trench after trench, to the end.

Where more than the produce of one bed is required for the supply of the family for twelve months, the third bed is next to be planted, which treat as directed for the first, only observing to lay the earth on the fourth, and so on for any number of beds, being careful to leave the earth of the beds which are planted as light as possible, and taking great care to avoid treading them at any time until the crop is in a proper state to take up, or to plant or sow other crops upon the ground; but upon every alternate bed, which is not planted, a dwarf annual crop may be grown.

About the month of May the plants will make their appearance, and in the course of the summer grow very strong. They must be kept clean from weeds; and as soon as the leaves decay in autumn, let them be carefully raked off with a wooden-toothed rake, which is all that is required until the following February, when eighteen

[illegible] of horse-radish may be taken up entire and sound, which for size and quality will be such as have not generally been seen. It is also necessary to be very careful in digging up the roots, to pick every [illegible] and piece of horse-radish out of the ground, as the smallest roots rarely fail to grow, and would, if left in the ground, injure the succeeding crop. The following February the one-year old crop will require additional earth, as before directed, and must of course be taken from those beds which are now vacant, which, when done, if the ground appears poor, or unlikely to produce another vigorous crop, they must have a coat of manure. The best manure for horseradish is leaf-mould, or other thoroughly decayed vegetable substances: when such cannot be got, cow or horses' dung may be used, but it should be in a very rotten state: this manure should be well mixed with the earth to the depth the horseradish is intended to be planted; after which the ground may be planted, in due season, as before directed. When horseradish is grown for market, it is customary to sell it with its crowns or tops perfect, consequently the market-gardeners have not always a sufficient quantity of crowns to furnish

furnish their new plantations; therefore, to make out this deficiency, they sometimes cut the old knotty roots into sets, which rarely produce good handsome sticks of horseradish. With little difficulty they might be accommodated with plenty of crowns, if they would take the trouble, which would be very little, to plant a quantity of their refuse horseradish in some inferior piece of ground, or unfavourable situation for more delicate plants, about six inches deep, and six inches apart from plant to plant, which, in the course of one year, would furnish any quantity; and, by taking off the crowns, each plant would furnish from one to four or five tolerable crowns, which, if necessary, might be repeated for several successive years, and with no more trouble than keeping the ground free from weeds.

On the Culture of the Potatoe in Hotbeds.

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.*

From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

THE potatoe being now very extensively cultivated under glass, and with artificial heat, any improvement of its culture will probably prove acceptable to many readers of the Horticultural Transactions; and I am therefore induced to send the following account of some methods which I have practised with success, and which will, I believe, be found better than any at present generally known.

The varieties of potatoes, which are well calculated for early forcing, begin to vegetate before Christmas; and it is of consequence to preserve the germs and roots

first emitted from injury, where a crop of good potatoes is required before the end of May. I therefore plant my potatoes in pots of about six inches diameter, in January (a single potatoe in each), and the pots are then placed in the ground, and covered with litter, to protect them from frost; and in this situation they remain till the hotbed is ready to receive them. In the mean time the roots extend themselves through the mould within the pots, and the germs reach its surface; whilst the excitability of the plants is not at all expended on account of the low temperature in which they vegetate: and, therefore, when plunged into the hotbed, they instantly shoot with excessive rapidity, and in a few days begin to generate tubers. One stem alone should be suffered to grow in each pot; for where more remain the tubers are smaller, and the crop is not increased in weight. When the plants grow in small pots, the gardener will have apparently the advantage of being able to take out the largest potatoes by inverting the pots, without materially injuring the fibrous roots; but this practice will rarely be found eligible, because the plants, having the range of their roots confined to the limits of the pot, soon occupy the whole of their pasture, and therefore do not produce their tubers in succession as they will under common circumstances.

The lights should be drawn off during the day, when the Spring is far enough advanced to permit this to be done without injury to the plants; and early in May the pots may be taken out of the hotbed, which may be employed for other puposes; and as it must necessarily have been kept very dry during the latter period of the growth of the potatoes, it will generally afford a strong heat on being well watered.

I confine

I confine my plants (which are naturally of very dwarfish growth) to small pots, because under this mode of culture the tubers acquire maturity sooner, and are better; but the crop is not so heavy as when their fibrous roots are permitted to extend more widely: and therefore, where a larger, but rather later crop, is required, the best plan is to put the tubers to vegetate in small pots, and from these to remove them, with their roots and germs uninjured, to the hotbed.

I tried the effect of placing a few tubers (half a dozen only) on the floor of my cellar, disposing them just in contact with each other; and as soon as the germs were about four inches long, a hotbed was made ready to receive them. This experiment succeeded perfectly; and as it is not attended with so much expense and trouble as either of the preceding methods, it will be found, in many cases, the most eligible. All that appears necessary to obtain an early crop, is to advance the growth of the plant, as much as convenient, under a low temperature, so as to avoid all unnecessary expenditure of its excitability; and, subsequently, to preserve its germs and roots as much as possible uninjured in transplantation.

Were the potatoe incapable of being raised by forcing in greater perfection than it is found in the markets of the metropolis, I should think the labour and expense of propagating it very ill applied: but the yellow variety, which is now very generally cultivated round London, and which is known in other parts of the kingdom under the name of *Fox's Seedling*, has no other merits, whilst young, than its earliness, and a moderately large produce, for in every other respect it is below mediocrity; and even when full grown it is never

excellent: indeed, a good potatoe for forcing does not appear to me to be at present in the possession of the market-gardeners of London.

I hoped to have sent this year to the Horticultural Society samples of two or three very early new varieties of potatoes, which I have obtained from seed by the process detailed in their Transactions of 1807; and for that purpose I had planted a considerable quantity. But, unfortunately, I planted them in a field at a considerable distance from my house, for the advantage of fresh soil, where the rooks, from a rookery in the neighbourhood, discovered, and so nearly destroyed the whole, root and branch, in June, that my best varieties but just escaped total destruction. Next season I hope to be more fortunate.

Iron Bridge over the Thames from Bankside, Southwark, to Queen-street, Cheapside, in the City of London, called the Southwark Bridge.

THIS bridge is to be constructed of three iron arches, the centre one of which will be of 240 feet span, and the side ones 210 feet each; the piers and abutments of stone. It will be so novel and magnificent a structure, that the Editors of the Repertory apprehend their readers will be gratified with some account of the reasons urged in Parliament, which induced it to pass an Act for incorporating the Subscribers, and enabling them to raise the necessary funds in transferable shares of £100 each: particularly as this account will afford some important information respecting the present state of London-bridge, and the effect it has on the River Thames and its navigation. The expediency and propriety of erecting

ing a bridge in the situation proposed, will appear evident from the following detail, and that the spirited subscribers will derive an ample revenue from the tolls.

The advocates for the measure stated:

That in consequence of the prodigious increase of inhabitants in and near the Borough of Southwark, and the several parishes, places, and villages, not only adjacent thereto, but in a line of communication therewith, and of the increase of commerce generally, the avenues leading to London-bridge on both sides, are become too confined and insufficient for the traffick therein.

That great inconveniences and interruption to the passage of carriages and foot passengers is thereby produced, lives endangered, and property injured.

That the Southwark-bridge is therefore desirable if not absolutely necessary, and will in a great measure, if not entirely remove the evils complained of; for by receiving as it will naturally from its situation, a great part of the traffick which now of necessity must pass over London-bridge, it will greatly facilitate the communication, and consequently benefit the commerce on both sides of the river. It will prevent a recurrence of those stoppages which now so frequently and injuriously happen on, and in the vicinity of London-bridge.

That it will be the means of opening a good and convenient street of handsome houses through a part of Southwark, at present occupied by buildings of very little value.

That an improvement of such importance to the Borough will doubtless be an introduction to others perhaps but little inferior, particularly that of making good and convenient streets of communication between Blackfriars-road and the Borough High-street; and probably of

making

making what is equally desirable, a commodious opening to the foot of London-bridge, from Bankside and the Southwark-bridge.

That by these means the Borough of Southwark will be enabled to partake of that share of the commerce of the metropolis to which it is so justly entitled from its central situation; but of which it has been hitherto deprived for want of sufficient convenient avenues of communication to that side of the river where all the principal offices of trade and commerce are situated. The Bank, the Royal Exchange, Stock Exchange, the Custom House, Excise Office, the Assurance Offices, the bankers, &c. &c. Guildhall, and the halls and offices of the incorporated companies.

That it will open another and more convenient communication from the heart of the City to the neighbouring villages in Kent and Surrey, which will form a very suitable residence for merchants and wholesale dealers.

That it will create in the Borough at large a highly respectable neighbourhood, and greatly enhance the value of every description of premises there situated.

And, the Editors understand, it has been considered by the promoters of the undertaking as an object of the first importance, that the altering or rebuilding of London-bridge is an event which sooner or later must take place, in order to lessen or remove the great inconveniencies which it causes to the navigation, and to prevent that lamentable loss of lives and of property, which are the consequences thereof to an amazing amount.

That it will enable the corporation, at any future period when the Southwark-bridge shall be erected, to make such alteration, or entirely to rebuild London-bridge,

bridge, with but little interruption or inconvenience to the trade of the Borough and City, operating in such a case in lieu of a temporary bridge, and preserving a free intercourse and communication with all the present avenues on both sides the river.

The City of London opposed the passing of this Act on the following gronnds: That,

1st. While London-bridge exists of its present structure some *additional danger* will arise to barges which pass through it at *some periods* of flood-tides.

2dly. That London-bridge in its present form is useful as a dam, to pen the water up the country.

3dly. That Queen-street is too narrow for a great thoroughfare.

The obvious answer to the first point was, that if London-bridge, from its structure, is the cause of danger, and is opposed to improvements on the river, it ought to be altered. That this is the case the extracts of evidence hereafter inserted most abundantly proves.

To the second point it was answered, that the premises are not founded in fact: that the contrary is true; and this is proved by the annexed evidence on that head.

To the third point it was answered, that although Queen-street is narrower than the public may desire, yet, it must be observed, that the Southwark-bridge and its avenues is not intended as a *substitute* for the conveniencies and avenues of London-bridge, but as an *addition* to them; therefore, though Queen-street is only about two-thirds of the width of Fish-street-hill, it will operate as so much additional convenience of passage; besides which, about 350 feet of Queen-street will be widened, *i. e.* from the river to Thames-street, to more than treble its present dimensions, and from Thames-street

memory of man, nor the water have been so much shallower above it than below it.

Suppose a bridge or dam of similar construction were erected at Gravesend, the bed of the river above it would rise in the course of time to be as shallow as now it is at London.

At one time, about the year 1763, the current through the great arch of London-bridge had so undermined the starlings, that above two thousand tons of stone were obliged to be thrown in, to prevent the immediate ruin of the bridge. That ingenious and eminent artist, the late Mr. Smeaton, was, on this occasion, the means of saving the bridge. It is, however, to be remarked, that *he was employed to save the bridge only, and not to improve the Port of London.*

Thus we find this bridge operating in every possible way to ruin the bed of the river; whilst a false notion is held out, that it is necessary to create deep water, whereas the contrary is the fact.

If then such enormous evils result from this bridge, which admit of only that one remedy, of rebuilding it, must it be said that we are unwilling or unable to apply this remedy? It shall never be said that no artist can be found to undertake the work.

The Expense of rebuilding it.—If the navigation of the Thames is worth preserving, it cannot be done without expense; for if the bridge is not re-built, the constant repairs of the old one, the expense of ballast-lighters, for a constancy, to make deep water above it, are no small considerations: and if any remedy is applied, rebuilding the bridge is the cheapest, unless the navigation be abandoned entirely, and the communication from the Pool, upwards, absolutely given up.

However,

However, as I believe every body will concur in thinking that an upward communication should be *preserved*, or indeed, I may with more truth at present say, *created*, I shall consider the expense of the means likely to be proposed; first remarking, that had a new bridge been erected some years ago, less damage to the navigation would have been occasioned; and that the longer this is delayed the worse, as the remedy becomes every day more difficult and expensive, but never impracticable.

There is a prevalent notion, (which I believe it requires not much science to refute,) that one objection to the proposed new channel is, that it will let too much water out of the river so as to prejudice the navigation. Those who make this objection are, I am afraid, unacquainted with the subject entirely, and do not recollect, that where a tide reaches twice a day to Kew-bridge, there can be no doubt that the *depth of water* comes from the *operation of the sea more* than from the *downward current.*

It must then clearly appear, that whatever tends more easily to admit the *operation of the sea* (which is the tide) must tend to *increase* the distance to which *that operation* must extend *upwards*, and consequently the quantity of descending water.

When the mischief done by this bridge to the navigation — the great expense of keeping it in repair — and the damage done annually to shipping by the ice it collects, are all considered, surely every means of remedying the nuisance ought to be attempted; and it would be fortunate if this bridge should, by neglect, so undermine itself as to be buried in its own ruins, (which would soon be the case, was it suffered to depend upon its

own merits for its support,) for, I believe, if it was but once down, the means of opening the river would soon be found, and also those of erecting a proper bridge in its place. Without this pile of mischief and deformity, all the ice would go into the sea, and be got rid of.

Extract from Mr. Ralph Walker's *Report to the Select Committee.*

During the times of the neaps, the floods are so much affected by the breadth of the bases of London-bridge, that the current immediately below does not run but very little more than at the rate of one mile in an hour, which gives time for the water to subside, and tends greatly to lessen the depth of the upper part of the Pool.

During the times of spring tides, the floods rise immediately below the bridge, at least nine feet perpendicular, before the current begins to run upwards through the arches. This accounts for the times of the flowing of the tides above bridge being not more than four hours, and the ebbing eight hours and a quarter nearly.

The evil consequences of the present bridge are partly stated: the rapid current occasioned by the small arches, and broad bases of the starlings, which are very much augmented for the purpose of giving greater velocity to the water-works, tends directly to ruin its foundations, and the navigation of the river, and is also the cause of many lives being lost annually.

During the times of severe frost the narrowness of the water-ways impedes the floating ice, and soon forms a solid body across the river, and puts a total stop to the commerce

commerce of the port at these times, which would not be the case if London-bridge had a sufficient water-way.

Upon these grounds forming a judgment, I am decidedly of opinion, that the present London-bridge is of very great injury to the navigation of the river, both above and below, in as much as it is the cause of shortening the distance that the tides would flow up towards Staines, &c. and also of being undoubtedly the cause of lessening the depth of the river, and occasionally shutting it up during the times of frost.

For the above reasons I would humbly propose that the present London-bridge should be taken down, and rebuilt upon a plan to give a sufficient water-way.

Extract from Mr. MILNE'S *Report to the Select Committee.*

From the period of altering the bridge, the stability of London-bridge has been always in questionable agitation; much work has been done, but no radical strength added thereto.

From what I have stated (in addition to what the Committee have been pleased to instruct the public on this subject), it may be easily conceived, a period of time will arrive by the concurrence of circumstances, that this bridge may unexpectedly be thrown down, as has been the case with several old bridges of similar construction.

If a severe winter, such as 1740, should produce large pieces of ice, and the tide should leave them on the broad shoal water above bridge, extending along the Surrey shore; and if the smaller arches should be in the greater part choaked by formidable floating ice, at

at the time the fall is at the greatest, and the *momentum* thereof increased beyond example hitherto known or experienced since the great arch has been opened, and its bottom left with the precarious, and, as we have seen, a removable protection, notwithstanding all the ingenuity, perseverance, and expense bestowed upon it, it is highly probable such a severe misfortune may happen.

The stone-work of London-bridge may be said, with *some truth*, to be such as to last for ages, if carefully renewed, but its figure and foundations contain the seeds of *sudden*, not gradual dissolution.

With respect to *what would be the probable effect of taking down London-bridge, as to the navigation of the river?* I feel a necessity of dividing this part of your request, in order to make myself understood.

If the bridge was totally removed, and nature restored to its full power and original possessions at this place, there cannot be any doubt but the navigation would be here, as to any place upwards to Fulham-bridge, free, open, and unincumbered, for all the variety of *craft* which navigate that extent of the river.

If the pass at London-bridge was free, the land floods of the Thames (which annoy its upper navigation greatly at times above Kew, to an extent of distance and effect little thought of), would have a ready passage to the tides-way and the sea, and thereby pass off the useless superabundance more readily. The high waters of the tides respectively, would be so much higher in this district, and the velocity so much stronger upwards, that the voyage would be done in less time, and with more safety, through a deeper water at each period of the tide.

During

During the seven hours of ebb passing through it, nothing can pass upwards; light boats, a little after high water or a little before flood, can hardly be urged against the stream by dexterity and strength; all communication and intercourse, therefore, from below, is completely cut off; the same exists with respect to the duration of flood for five hours, when no person can get through it against the stream, and many there would be who would chuse to go by water, during these suspended large intervals, on the concerns *of trade, and the business of shipping*, were it but in their power. This is an advantage only to be imagined, since by the long existence of London-bridge, the present age do not know, and cannot appreciate, how much has been lost, and what they have been deprived of, through the conduct of our predecessors.

The little knowledge of that period which created London-bridge has handed down to after-times a structure, which, strange to say, became a wonder, and even received admiration.

And, it is still stranger to say, that 90,000*l.* was laid out, and the revenues of a large estate expended, to preserve it.

[The Editors are informed the repairs are not less than 5000*l.* a year.]

Extract from the Report of the Select Committee to the House.

The Select Committee of the House of Commons state, that your Committee, from a variety of circumstances stated in their second Report of last year, were led to consider the condition of London-bridge, as the next object requiring their attention; and they find, that notwithstanding a large sum of money has been annually

nually applied to the repairs of this bridge, that the methods employed to secure it have, in several instances, proved wholly ineffectual: that the bed of the river suffers perpetual and increasing injury from shoals, occasioned partly by the obstruction of the natural course of the tide, and partly from the dispersion of the materials employed for the purpose of strengthening the bridge: that for several hours in each day, the navigation downwards is impracticable for small boats, and hazardous even for large craft, and all navigation upwards totally prevented.

They have annexed in the Appendix to this Report, Mr. Mylne's answers to the questions proposed to him by your Committee; which contain a very elaborate and important investigation, illustrated by several designs respecting the construction of London-bridge, and the state of the bed of the river in general, and particularly of the effects produced on it by the bridge.

It appears from these observations, that the structure of the bridge is so defective in its original design, that no art or expense which has been or can be bestowed on it, can secure it from the risk of a *sudden and total destruction*, under certain circumstances of the river; and that in ordinary circumstances, it receives continual injury from the rapidity of the current, occasioned by the narrowness of the arches, and requires frequent support from the addition of new materials; all of which are in no long time washed away, and add to the shoals which the bridge has already been the means of forming.

"Your Committee, being convinced from these inquiries, as well as from the information collected by them last year, that the rebuilding of London-bridge, upon improved principles, would be a measure of substantial

stantial economy in itself, as well as subservient to other purposes of still greater importance."

"All the architects propose that the present bridge should be left standing, for the purpose of temporary accommodation, during the erection of a new bridge; and this affords an additional reason for the proposed change of situation to some distance, as great inconveniencies must take place from the demolition of buildings, or the construction of lofty causeways, immediately contiguous to so crowded a passage."

Extract from Mr. RENNIE'S *Examination.*

I have lately examined the state of London-bridge, and find several of the starlings a good deal gone; and I find the bridge very much cracked in several places, I mean the arches and one of the piers. The pier of the great arch, and the small arch on the South side of the great pier, I find split in two places. In the one I put a pole six feet deep, and in the other I put a pole in five feet deep. The starling of the second pier, from the large arch on the north side, has most of its timber gone, and the rubble is quite exposed to the face of the current. If I had seen any other bridge in the same situation that I saw London-bridge in, I should certainly have recommended the taking of it down, because I should have thought it a bridge not likely to stand for any considerable time. I have long thought it to be in a very dangerous tottering state; but London-bridge, as far as I have been able to obtain information about it, has been considered by Mr. Milne, and by other gentlemen whom I have consulted, to have been for a long period in a very dangerous state, notwithstanding which, by the considerable repairs that have been given to it, it still continues to stand. If the City had employed

me to survey it upon the present occasion, I should certainly have recommended a new bridge to be built in the place of it. It acts in part as a dam, and prevents the tide from flowing so far up the river as it otherwise would do if London-bridge was removed. Q. Is that attended with bad consequences to the river itself, as far as the channel of it is concerned? A. It is in my opinion very much so. — Q. Are there shoals immediately above and below London-bridge? A. There are. — Q. Are those shoals in any manner created by London-bridge? A. They are in my opinion. — Q. Will not the continuation of the practice of throwing rubble into the arches produce bad effects upon the bed of the river? It will. — Q. Are you able to form any judgment what consequences would arise from the throwing no more rubble in, but leaving the bridge without that assistance or that operation? A. I should apprehend that in time the bridge would be carried away. I do not apprehend any mischief likely to arise from the increased flow of water that would take place from a bridge being placed in the situation of London-bridge with more water-way. London-bridge is, in my opinion, a very serious cause of obstruction to the navigation.—Q. Would a severe frost, and the accumulation of ice in the river, at all accelerate the downfall of this bridge? A. Yes, I think it would. — Q. Suppose the bridge instead of being taken down regularly was to tumble down, what would be the effect produced by that? A. I suppose it would form a great dam in the river, and the water would overflow all the country on the sides of the river for a great distance above bridge. I speak from the experience I have had of other bridges in similar situations, and I will name one. The bridge over the Tweed at Kelso, which I had known for thirty years, was supported by a stone starling

ling round its piers. That bridge during one great ice-flood had four of its arches out of the six very much choaked with ice; and the current running between its narrow starlings and the other two arches, dug out the bottom, and swept the whole away. I can only reason upon similar principles in respect to London-bridge. It is impossible for any professional man to speak decidedly upon such a structure as London-bridge; but I consider it to be one of those structures which, when a failure, arising from such a cause as I have stated in the base of the bridge at Kelso, or whenever circumstances combine to create such a cause as I have mentioned in reference to the bridge at Kelso, I conceive that London-bridge would give no warning, but would tumble down all at once. I have no opinion that the foundations of London-bridge will last for ages: as to the stone-work, I have no doubt of its durability, provided the foundations stand. My doubts are exactly upon the principles that I have before stated, that if a combination of circumstances, which now and then does happen, should take place, I would not insure it for one week. I have known several bridges (one I have already mentioned) that have been carried away for want of a sufficient water-way, which I think London-bridge does not possess. — Q. This combination of circumstances would affect the foundation I suppose? A. Yes, remove it. — Q. Dig it out from below, and by that means undermine the points of the piles, and so destroy the bridge? A. Yes.

It was stated in evidence, by several lightermen, that between twenty and thirty lives, and between 30 and 40,000*l.* worth of property were lost annually in the vortex of London-bridge.

Method of converting a common Ship's-boat into a Life-boat. By the Rev. James Bremner, *Minister of Walls and Flota, Orkney Islands.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Silver Medal of the Society was presented to the Author for this Communication.

HAVING a great many years ago witnessed a melancholy scene of shipwreck, and seen men perishing at little more than the distance of one hundred yards from the shore, it forcibly struck me, that though there was no possibility of getting from the shore to them, yet, there was a great probability that means might be found by which those in such situations might with safety be enabled to effect their escape to the shore; and further considering, that the very precarious aid of some accidental piece of wreck (under every disadvantage, and in a tempestuous sea) sometimes serves to save life, I was confirmed in the opinion, that some method might be devised which, upon good grounds, would hold forth the promising prospect of safety in all the common and general cases of shipwreck. Hence it was that to devise such a scheme became the object of my research ever after.

The following plans (especially the first) are so simple, and the effect so obvious, that I cannot allow myself to think, that any seaman can entertain the smallest doubt but that a boat so prepared would live in any sea whatever, could neither sink nor overset, and could carry in safety a number of people, in proportion to her size, over

over a bar, or from the wreck to the shore through any surf.

That empty casks must float, almost wholly above the surface of the water, is so clear, that no person can be so absurd as to question it; and it is equally certain that every cask will support weight of any kind in proportion to its size. In order then to accomplish the end proposed there is only one thing more wanted, and that is, by means of sufficient seizings or holdings, to secure the casks in their places. Were you to tell a seaman that he is not master of this mighty operation, it is easier to conceive than to express the contempt he would feel, and the energetic reply he would probably make to such a supposition. If then these are undeniable points, it must follow, that wherever the boat can be had recourse to, all that is contended for in the plan must be granted.

It no doubt has been upon these simple and obvious principles that those corporate and public bodies, and hundreds of seamen to whom the plan has been communicated, have so readily and entirely approved of it. But however respectable and authentic these testimonies (afterwards to be mentioned) may be, I lay no stress upon that point, neither do I ask any credit for it, but freely submit my statements to the great body of seamen in general, leaving them to be judged of, not with liberality only, but with severity, considering that it would be a crime of the first magnitude, to advance a single argument or suggestion that could have the smallest tendency to mislead, in a matter so solemn and important, as where life and death are concerned.

Were I to go back to cases that are well known to have happened, I could easily point out many, wherein had

had this plan been thought of, there can be no doubt but it would have been attended with the happiest consequences; and probably the recollection of many seamen may furnish cases of the same kind, which have happened within their own knowledge.

I shall only add, that I expect no benefit nor advantage whatever to myself from my perseverance and labours on this subject, nor reimbursement for an expense of some hundred pounds which it has cost me in repeated journies to Edinburgh and London, as well as in experiments, which a living of less than seventy pounds a-year could very ill afford; but I shall nevertheless reckon myself amply rewarded, if what I have to propose shall at any time, or in any case, prove the means of relieving from the deepest distress, and of rescuing from otherwise inevitable death, even a few of those who have had the misfortune to be involved in all the horrors of shipwreck.

Mariners are unavoidably exposed to incomparably greater hardships and sufferings, than what are to be met with in any other line in human life.

Whilst the labours of all others are moderate, and find relief at stated intervals by day, and repose by night, the seamen must contend with the storm so long as it lasts, and encounter danger at a moment's warning, whether at midday or midnight. Whilst the tempest rages, no respite can be allowed him; he must keep his station without intermission, and after toiling above strength and above measure, it is often his hard fate to be shipwrecked at last.

The complicated distress attending this frequent and fatal disaster, it would be in vain to attempt to describe in any words, nor is it possible to conjecture nearly the number

number which is added annually to the innumerable multitude of dead which the ocean contains.

Sometimes several hundreds in one ship are involved in this direful calamity, where the misery of each sufferer is increased, in proportion to the accumulated woe that surrounds him; the cry of despair is heard on every side, and in distraction each exclaims, What shall we do?

Amidst overwhelming waves and wreck, the mariner suffers in his person all that a living man can undergo, and in his mind all the anguish that despondence can create, heightened by the agonizing thought, that he is never more to behold wife, child, family, or friend; still however amidst all his sufferings, an ardent love of life prevails, and the hapless mariner, struggling hard to preserve it, clings to whatever seems to promise a momentary reprieve.

In the mean time the wreck is rapidly giving way, some are washed away in one place, and others in another; those who remain redouble their efforts for life; but alas! they strive in vain; one decisive blow has dashed their last and only support to pieces, and all are going down together—a general shriek is heard—to be heard no more! the melancholy scene has closed, and neither survivor nor wreck is left behind.

Any plan then that has for its object to afford relief in situations of such extreme distress, and which seeks to extend the same benefits to thousands of perishing men in future ages, will no doubt meet with a favourable reception from every humane and benevolent mind.

But humanity and true benevolence, are not merely speculative, but active principles; and wherever they really

really exist, the helping hand is instantly stretched forth, to execute the dictates of the feeling heart.

As no subject can be more interesting to individuals than the present, nor more important to society, may it not then be expected, that every friend to humanity and to his country, will not only heartily wish success to the present plan, but also lend his best assistance to have it brought into all the practical effect, of which it may be found susceptible.

It is to be understood, that the plan is intended to apply to cases of shipwreck in general, and that it may very often succeed even in cases of extraordinary difficulty and peril.

This will comprehend the far greater number of all shipwrecks that happen, and the author thinks himself warranted to say, that no solid objection can be offered to the effectual operations of his plan to this extent, and that it will be found fitted to answer all the purposes of a life-boat, by saving lives, where otherwise men must inevitably have perished.

At the same time he begs it may be understood, that he does not speak with this confidence, from his own opinion only, however well-founded in principle and experiment it may be, but because the plan itself, after repeated investigation, has received the unanimous testimony and approbation of professional men, and of men too who must be allowed to be the most competent as well as the most respectable judges in the kingdom, namely, the Trinity House of Leith, in whose records a copy of it will be found.

The Report of the Highland Society of Scotland confirms that in their Committee appointed to witness the experiment at Leith, there were naval men of that

number

number who were competent judges, and in whose skill they could confide, and for this reference is made to the Appendix of their second volume.

It has been repeatedly submitted to the Trinity House of London. It was first transmitted to them by Lord Melville, the treasurer of the navy, and their answer under the hand of their secretary is inserted in the forementioned Appendix, signed James Court.

In the next place, the plan having been laid before the Royal Humane Society, and they not being naval men, do submit every essay of that nature to the Elder Brethren of the Trinity; and in consequence of their approbation a premium of five guineas was given by the R. H. S. as appears from their printed Reports 1800 and 1801.

And to these attestations might be added, the subscribed approbation of more than one hundred ship-masters, whom the author had occasion to see only accidentally, and whose subscribed names are now in his possession.

It is under the sanction of such authorities and documents that it is now offered to the public, and they are such as must be satisfactory to every impartial and candid mind.

They have been obtained without interest, favour, or friend, and small premiums have been given without the author's knowledge, till informed by letter that his plan had received this mark of approbation.

It is impossible therefore to ascribe so honourable testimonies and gratuitous bounties to any other motive than to the conviction of the utility and efficacy of the plan, and an ardent desire to promote an object so de-

[redacted]

voutly to be wished as the preservation of lives in cases of shipwreck.

The inventor trusts that his statements will shew, that he is not unacquainted with his subject: and he shall only add, that he has had more than forty years experience in the use of boats, among dangerous tideways and rapid currents, such as the Pentland Frith, and all the other channels among the Orkney Islands; and that he has been several times at sea on shipboard, in storms that were attended with shipwrecks; and that from such experience he is perfectly convinced that his plan is sound and unexceptionable, and is confident that the period is not very distant, when it will come into as great repute and general use as life-boats, properly so called, are now known to be.

The plan may be executed upon boats of all dimensions, and the largest, provided they could be got out, would be found the most advantageous; but all circumstances considered, the size deemed in general best adapted for the purpose would be any boat from sixteen to twenty feet in length, which is to be prepared as follows.

Two additional ring-bolts are to be fixed in the keel withinside of the boat.

One to be placed one-third of the boat's length from the stem.

The other one-third from the stern.

Two augur bores are to be put through the keel without-side, and close to the garboard stroke.

One of these bores to be put about half way betwixt the ring in the stem, and that next to it in the keel.

The other about half way betwixt the ring in the stern, and that next to it in the keel.

Plugs,

Plugs may in ordinary be put into these bores, to be struck out, when occasion requires.

Those ring-bolts which are in ordinary in every ship's-boat, the two additional ring-bolts in the keel, and the two augur bores, are all intended as secure points of fixture, to which seizing ropes are afterwards to be attached.

In the next place, two tight empty casks are to be provided, of such dimensions that their length may fit to the width of the boat, when laid athwart ship, and their diameters to be about three feet, and if larger so much the better.

Each cask must be furnished with a sling on each end, and each sling to have two eyes on it, about six inches asunder, and the slings so put on the cask as that the eyes may be on the upper side when laid into the boat, that the seizing rope may pass through those eyes, in their way from ring-bolt to ring-bolt.

One of these casks, so prepared, is to be laid in foreward, and the other aft, and each cask so near its respective ring in the keel, as only to leave sufficient room for passing the seizing rope through the ring in the keel.

By this means, the vacant space, to be then filled up with cork, will be left betwixt the cask and the bow foreward, and betwixt the other cask and the stern aft.

The requisite quantity of cork, according to the dimensions of the boat, and the quality of the cork, may be about a hundred and a half, or two hundred weight, for each end of the boat, and that for each end ought to be made up into two separate bundles, each bundle being fitted to the width of the boat, and the uppermost one forming an arch from gunwale to gunwale.

The cork is to be made up in canvas, done over with soft pitch for preservation, and each bundle marked and numbered according to its place.

The cask and cork being laid into the boat, seizing ropes are then to be applied for securing them in their places.

Here it is to be observed, that the single turn of rope which is to go through the augur bore in the keel and round all, should be the first made fast, that the other seizing rope (which we shall suppose to have been made fast to the ring in the stem) may, in passing through the eyes on the sling, take in the surrounding rope betwixt the two eyes, which will thereby prevent the surrounding rope from slipping to either side of the cask.

The seizing rope having passed through the eyes on the sling, is then to be passed on through the ring in the keel, and thence back again, in the same manner, through the eyes on the sling on the other end of the cask, to the ring in the bow; and, lastly, the seizing rope is to be brought directly from the ring in the stem to the ring in the keel, by which it will cross the cask at the bung or middle part of it: the other cask and cork aft are to be secured in the same manner.

The preparation will be completed by attaching a bar of lead or pig-iron, of about two hundred weight, to the keel within side, by means of the ring-bolts in the keel, or otherwise.

The same plan may be executed with equal effect, and nearly with the same expedition, by the following alteration and arrangement.

Instead of one large cask, two less ones may be used in each end of the boat.

These

These are to be laid in lengthwise, fore and aft, in the boat, along side of each other, and both together ought to fill the width of the boat.

These must also be furnished with slings on each end, and with two eyes on each sling, and these eyes so placed as to be about two inches above the horizontal diameter of the cask, one eye being on each side of the cask when the sling is put on.

The seizing rope being now made fast to the ring in the stem, is to be passed through the eyes on the slings on one side of the cask, then through the ring in the keel, and so back again through the eyes on the slings on the other side of the same cask, to the ring in the stem. The rope is then continued on till it has passed in the same manner on both sides of the adjoining cask, and the last turn is to be made directly from ring-bolt to ring-bolt, passing over and above the surrounding rope, which will thereby be brought down in the middle betwixt the two casks, and made closely to compress them on each side.

TO BE CONCLUDED IN OUR NEXT.

On the Preparation of Blanc de Krems or Carbonate of Lead. By M. MARCEL DE SERRES.

From the ANNALES DE CHIMIE.

With a Plate.

THE preparation of carbonate of lead is very well known, but however easy it is, it has not yet been manufactured in the other parts of Europe, of so fine a white as it is prepared in Germany, and known in commerce by the name of Blanc de Krems.

The Blanc de Krems has been thus called because the first preparations of this colour were made in the town of that name; but for a long time the establishments that existed at Krems have been unemployed, and the finest manufacture of this kind is now at Klagenfurt in Carinthia, which belongs to Baron Herbert, and is much more considerable than that at Feldmuhl, belonging to Baron Leykam, or even than that at Vienna.

To give a complete idea of the German method of preparing it we shall describe the different operations they pursue in their processes.

First operation. The lead that is used in all the manufactories of *Blanc de Krems*, comes from Bleiberg near Willach in Carinthia. This lead is very pure, and appears to contain no ferruginous oxyd, which is essential to the beauty of the white, therefore the establishment at Klagenfurt is more advantageously situated than the others, from having the lead so near.

The lead is melted in the ordinary vessels, and is then run into sheets of various thickness. To make these sheets, the melted lead is poured upon an iron plate

plate disposed above the cauldron, and as soon as the surface of the metal begins to consolidate, the plate is inclined a little, the lead that is yet liquid falls again into the cauldron, and that which is congealed remains upon the plate. It is then taken off like a sheet of paper, and the workmen, taking care to cool the plate with water, can easily melt several quintals of lead in a day. The sheets of lead vary as much in their size as in their thickness; in some establishments they are half a line thick, and in others scarcely a quarter of a line. In some manufactories, a single sheet fills the width of the case, in others it takes four; it is essential not to smooth the surface of the sheets of lead, as it is evident that a rough surface is more easily attacked by the vapour of acids than a smooth one which offers fewer points of contact.

Second operation. When the sheets are formed, the next operation is to dispose them so as they may easily be attacked by the action of the acids; to this end, they are doubled and placed on small pieces of square wood, which reach across the cases in which the sheets are disposed. These sheets thus suspended by the middle, something like the leaves of a book, are placed with the pieces of wood that sustain them in wooden cases. The size of these cases is nearly the same in the different manufactories, their length is about from five feet to four feet and a half, their width from one foot to one foot two inches, and their heighth from nine to eleven inches.

These cases are made very firm; they are very careful to have them mortised, and that the nails do not start beyond the wood, they are never lined with lead, but the bottom has a bed of pitch in it about an inch thick;

thick; they are luted with paper in the manufactory, where the stove is heated with steam or vapour, because the vapours of sulphurated and phosphorated hydrogen gas is injurious to the white colour, and also attacks the oxyd of lead with avidity.

In Carinthia they formerly employed the method that they have in Holland of rolling up the sheets of lead, and placing them in this form in the cases; but this appears less advantageous, as it is evident that these rolls present less surface to the action of the vapours, and that they often fall into the liquid which is at the bottom of the cases; an accident that should be carefully avoided, because the carbonate of lead that results from it is always less white. The sheets thus disposed and suspended on the pieces of wood, are placed in the cases, about two inches and a half distant from the bottom. The sheets of lead are not suffered either to touch each other or the wood of the cases; for if they touch each other, the vapours cannot corrode them so easily; and if they touch the wood, the carbonate of lead is coloured, and the whiteness is injured. Before the sheets of lead are placed in the cases, a particular mixture is put into them, which is not the same in every establishment; the proportions of this mixture in some of them consist of four pints of vinegar to four pints of wine lees; and in others it is made of ten parts (20 pounds) of wine lees to 4½ parts (8½ pounds) of vinegar, and half a part (half a pound) of carbonate of potash. It is evident, that in those establishments in which they employ no carbonate of potash in their mixture, nor steam to warm their cases, it is necessary to lute them; and that on the contrary, where these articles are not employed, it is absolutely necessary that they should be luted.

The managers of the different manufactories recommend the most opposite materials, and that for reasons which it is easy to understand.

Third Operation.—The mixture being poured into the cases, and the sheets of lead disposed in them, the cases are taken into a particular place or stove. It is in this stove that, by means of heat, the vapours of the mixture, which is at the bottom of the cases, rise, and corrode the sheets of lead, and form a carbonate. The stove is warmed by two furnaces; it usually contains ninety cases, and has but one opening, which serves for a door. Although it is not very important to give the exact dimensions of these stoves, I shall, nevertheless, give those of the one I measured, which was nine feet high, four fathoms wide, and five fathoms long. The heat should never exceed 30 degrees of Rheaumur, which is usually continued for fifteen days, and at the end of that time the operation is generally terminated. If the heat be too powerful, the vapour being too copious, a great portion of the carbonic acid escapes, and the lead being less attacked by the vapour, the product in carbonate of lead is consequently considerably less.

When the operation has been well conducted, as much carbonate of lead is obtained as there has been lead employed before the operation: thus three hundred pounds of lead put into the cases, produce three hundred pounds of carbonate of lead; and there also remains, after the crust of carbonate of lead is entirely shaken off, a certain quantity of lead, which is melted again to form new sheets. The mixture will serve but once, and when there is potash in it the residue is sold to the hatters.

Fourth Operation.—When they judge that the preceding operation is terminated, the sheets of lead are taken

taken out of the cases, and they have then acquired a thickness of a quarter of an inch, and even more than that, whereas before they were hardly a quarter of a line. They often observe on the edges of these sheets largish crystals, which are nothing but acetate of lead. The sheets on being taken out of the cases are violently shaken, in order that the carbonate of lead formed on their surfaces may fall off. The carbonate thus obtained is put into large tubs, and there, by washings, is rendered as pure as possible. Thus, when by chance some pieces of lead remain among the carbonate, they wash it, to separate the lead from it: and this operation has also the advantage of separating the acetate of lead, if any exist in it.

The manner of washing the carbonate of lead is very simple, and similar to many other processes of this kind. They use for this purpose a large wooden tub, generally of a square form, and divided into several compartments, the number of which vary from seven to nine. These compartments are equal in capacity, but unequal in height, so that those which are too full run over into the next: thus, for example, if the first case be too full it runs over into the second, and so on to the rest. The water that is poured into the first passes successively into the others, being agitated a little at the same time. The water deposits proportionably the white that it carries with it, and the precipitate of white lead that remains in the last case is the finest and the lightest. When the white lead has been washed in this manner it is deposited in larger tubs, where it is again washed, and left in the water. It should be observed, that when the carbonate of lead is washed with water, a white skim rises to the top, which always floats, and appears

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to be a sort of acetate of lead. In order to precipitate the small quantity of carbonate of lead that is in it a little potash is added, and then the carbonate precipitates. However, this phenomenon deserves to be more particularly considered. The carbonate, when purified by the washings, would, if left in the tubs, retain always the consistence of a liquid paste; but on being taken out of the tubs with a wooden spatula, and deposited on dryers, when it comes in contact with the air it soon acquires the consistence of a soft paste; it is then put into moulds, in order to give it a convenient form for sale.

All carbonate of lead in commerce would be nearly of the same quality if it were not mixed with other substances, by which means various sorts are introduced which we shall describe, and also give their different appellations.

First sort.—The carbonate of lead that is deposited in the last division of the tub is the finest: this is carefully prepared, and is known in Germany as *Kremserweiss*, or *Blanc de Krem;* it is also known under the name of silver white, and is what is used in medicine and painting for the most delicate purposes. Sometimes the carbonate that floats is the whitest: this is entirely pure, and they never mix sulphate of barytes with it, as they do with the inferior sorts; so that it may with certainty be considered as pure carbonate of lead.

Second sort.—This is formed by a mixture of equal parts of sulphate of barytes with the carbonate of lead, and is known in Germany by the name of *Venerianerweiss*, or *Venice white.*

The sulphate of barytes, that is used for this purpose in Germany, is brought principally from the Tyrol, and

 some

some of it from Styria: the former is infinitely better than the latter, because it contains no oxyd of iron. The feruginous oxyds that may happen to be contained in the sulphate of barytes are very prejudicial to the beauty of the white, especially as, in order to pulverise the sulphate with greater facility, they calcine it, and the calcination colours that of Styria, by reason of the oxyd of iron it contains, whilst that of the Tyrol remains always white; but in some establishments, where they have perceived this inconvenience, they have discontinued the calcination.

Third sort is formed by a mixture of two parts of sulphate of barytes to one of the carbonate, and is called *Hamburg white.*

Fourth sort is formed by a mixture of three parts of the sulphate to one of the carbonate; this is called *Dutch white.*

All these different sorts of white are generally made in the proportions we have given; yet when they wish to make a cheap sort, they put seven parts of sulphate of barytes to one of carbonate of lead, and this is also known under the name of Dutch white. Except for delicate paintings, it is advantageous for the white lead to be mixed with sulphate of barytes, for a very simple reason, the great defect of the carbonate of lead is, that it will not cover a surface when laid on with a brush, and the sulphate of barytes corrects this inconvenience.

It now only remains to give the method used for pulverising the sulphate of barytes, and mixing the carbonate of lead with it; the first is performed by means of a pounding mill; they put the sulphate of barytes on a plate of iron pierced with holes, through which it falls

in a powder into the vessels that are placed to receive it.

The grinding of the carbonate of lead, and its mixture with the sulphate of barytes, is done with a mill that is extremely simple, and is much used in the manufactories. As it may be useful to be well-informed of the German method, we have added a description and plate of this mill.

Explanation of the Plate.

Fig. 1 (Plate VII.) is the mill complete. The workman employed puts in motion the moveable mill-stone *c*, (the diameter of which is from twenty-two to twenty-four inches,) by means of a pole, the upper end of which is passed through a ring that is fixed in the wall or ceiling, and in which it moves freely. The lower end of the pole is furnished with an iron ring, and terminated by a pin, which enters into a hole made on the circumference of the mill-stone. It is clear that the stone turns round its centre when the workman moves the pole in a circle.

The white lead, whether mixed with the barytes or perfectly pure, is poured into the opening *c*, and then the workman stops from turning the stone. When the material is sufficiently pounded, it is made to run out by the spout *d* into the recipient *e*: the piece *f g* is made part of stone and part wood, which prevents the liquid from scattering about, and serves to make it run gently in the canal *d*.

Figs. 2, 3, and 4, shew the machinery by means of which the stone is raised and let fall, in order to grind that substance.

In

In the lower surface of the stone a piece of iron *a b* is let in, which has a small hollow in the middle, which is also the centre of the stone. By means of this cavity the stone is supported at the point *d* of the spindle *d e*, Fig. 3, which point passes through the stone. This spindle rests in *f*, Fig. 4, upon a cross piece *g h*, which forms a sort of lever, of which the point of support is at *g*. This cross piece or lever may be raised or lowered at *h*, by means of a screw, which has a key at *i*. These two movemenrs are easily performed with this machinery.

To prevent the liquid from entering into the cavity of the lower stone Fig. 3, between the spindle *d e* and the sides of the hole, this space is filled up by a piece of wood, which contains the spindle, and is surrounded by a piece of woollen cloth, that the liquid may not run out.

To make the complete mixture of the sulphate of barytes with the carbonate of lead, they reckon, that to mix a hundred pounds it takes half a day to do it properly; as for the rest, it varies according as the sulphate of barytes has been more or less pulverised.

General Observations.

From the account we have here given of the operations that are required in the preparation of carbonate of lead, it appears astonishing that this preparation, known by the name of *Blanc de Krems*, should have been but imperfectly imitated in the rest of Europe; it cannot be owing to the quality of the acetic acid that they use in Germany, since, in several establishments, they use all sorts of vinegar; even at *Klugenfurt* they often employ
- vinegar

a vinegar made from wild apples, which is far from strong; nor can it be owing to the mixture of sulphate of barytes, since the *Blanc de Krems* of the best quality contains none of it.

It may, perhaps, be owing to some of the following causes. First; the purity of the lead of Villach, (which does not contain even silver, a very rare thing,) may contribute to the beauty of the carbonate of lead: it is evident, that in the preparations that have a mixture of sulphate of barytes, the purity of this substance decides the beauty of the white. Secondly; to the method of washing the carbonate, as it appears that in this part of the operation principally consists the dexterity of the workman, and one who best understands it, is considered the most useful. On this process, so apparently simple, depends, as it appears, in a great measure, the beauty of the white lead. Thirdly; the grinding, which, although simple, has a great effect on its appearance. Fourthly; the method of suspending the lead in sheets, which favours the action of the vapours; consequently more of the lead is decomposed, and the carbonate more perfect. Fifthly; to the mode of evaporation. The slow evaporation that is adopted in the German establishments is favourable to a successive developement, so that the vapours attack by degrees the lead that is exposed to their influence. It results, therefore, that very little of the vapour is lost, and a superiority in weight and quality is given to the carbonate.

List

List of Patents for Inventions, &c.

(Continued from Page 64.)

WILLIAM EVERHARD Baron Van DOORNICK, of Broad-street, Golden-square, in the county of Middlesex; for an improvement in the manufacture of soap, to wash with sea water, with hard water, and with soft water. Dated April 27, 1811.

WILLIAM CASLON, the younger, of Salisbury-square, in the city of London, Letter-founder; for an improvement in the register belonging to a mould for casting types. Dated April 27, 1811.

GEORGE ALEXANDER THOMPSON, Gentleman, of Parliament-street; for machinery for the purpose of dragging, locking, and scoiting the wheels of carriages. Dated May 1, 1811.

STEDMAN ADAMS, of Connecticut, one of the United States, now residing in London, Esquire; for the application of mechanical powers to the propelling ships and vessels of every description through the water. Dated May 1, 1811.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXI. SECOND SERIES. Aug. 1811.

Specification of the Patent granted to ARTHUR WOOLF, *of Lambeth, in the County of Surrey, Engineer; for certain Improvements in the Construction and working of Steam-Engines, calculated to lessen the Consumption of Fuel.* Dated June 9, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Arthur Woolf do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows; that is to say: The working cylinder of my said steam-engine has no bottom, but is inclosed in another cylinder, of such dimensions that the space between the two (which space I call the receiver) is equal to at least the contents of the working cylinder. The inclosing cylinder has a bottom, and the two cylinders are joined together at the top by flanches, or any other suitable means; and the lower rim of the working cylinder is about as far distant from the bottom of the inclosing cylinder as the distance between the sides of the two cylinders. (N.B. Though

 I have

I have called the inclosing vessel *a cylinder*, it may be of any other figure fit to receive the working cylinder, as will be rendered sufficiently obvious by explaining my mode of working, which is as follows.) Instead of having a void space for receiving steam below the piston, or whatever may be used instead of a piston, I introduce below it, and into the receiver, such a quantity of oil, fat of animals, wax, or any other substance not too volatile, and which may be kept fluid by such a temperature as may conveniently be commanded, as shall, when the piston is at its greatest height in the working cylinder, fill all the space below it, and also fill the receiver up to the height of a few inches above the lower rim of the working cylinder. Things being thus arranged, if the engine is to be worked by the pressure of the atmosphere the receiver has a communication with the boiler. This communication being opened, steam is admitted into, and fills, the receiver above the oil, or other fluid body. If the communication between the receiver and the boiler be now shut off, (by any of the means in common use, or by any other means,) and a communication be opened from the receiver to the condenser, (previously exhausted by the usual means,) a vacuum will be formed in the receiver, and then the pressure of the atmosphere, acting upon the piston, will cause it to descend in the working cylinder, pressing the oil, or other fluid body before it, and causing the fluid body to ascend into the receiver, after which the steam is again admitted for the next stroke. If the engine, instead of being worked by the pressure of the atmosphere, is to be worked by the action of steam upon the piston, then the working cylinder must, as usual in steam-engines so worked, be furnished with a cover. In this case, whether

ther the engine is to be worked as a single or as a double engine, instead of the communications usual in the engines in common use; *viz.* for the alternate admission and condensation of steam above and below the piston, the communications of my engine are to the upper part of the working cylinder; and to the upper part of the receiver; the receiver in my engine answering to the space below the piston in other steam-engines, so that when the receiver is open to the condenser, and the upper part of the working cylinder open to the boiler, the piston descends, and *vice versâ.* It may be proper to remark here, that though I have described my receiver as containing and surrounding the working cylinder, because I prefer this arrangement, yet the receiver may be a separate vessel, connected with the working cylinder at the lower part. It is also proper to remark, that, to prevent waste of steam by unnecessary condensation, and to keep up the temperature of the oil, or other fluid body employed, the receiver may be inclosed in a steam-case, or heat may be applied to it externally. Lastly, whatever arrangement or mode of working be adopted, there should always be some oil, or whatever other fluid body may be used, above the piston, to the height of a few inches, to prevent the passage of the atmospheric air or of the steam downwards by the side of the piston; and as the quantity of oil, or other fluid body above the piston, may deviate from a given height by the working of the engine, means must be provided to restore it to the requisite height, as cocks, valves, or any suitable contrivance, regulated by a float or floats upon the surface of the oil, or by means of a pump or pumps, worked by the engine itself, or otherwise. By the interposition of the oil, or other fluid body be-

tween the piston and the condenser as before described, all waste of steam, by passing the piston, is effectually prevented, and a consequent saving of fuel is effected.

N. B. As it is usual for the pistons of steam-engines to work in steam-vessels of a cylindric form, I have in the preceding description, for the sake of perspicuity spoken only of the piston working in a cylinder, but the piston may work in a four-sided or any other polygonal prismatic-formed vessel.

In witness whereof, &c.

Specification of the Patent granted to JOHN CRAGG, *of Liverpool, in the County Palatine of Lancaster; for certain Improvements in the casting of Iron Roofs for Houses, Warehouses, and other Buildings, and in covering the same with Slates.* Dated November 21, 1810.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso I the said John Cragg do hereby declare that my said invention, and the manner in which it is to be performed, are described as follows: I make and cast iron rafters, with a shelf or shoulder at the side, of the breadth of one or one and a half inch on each side, upon which the slate rests between two rafters, (the rafters being first primed with paint,) bedded in cement or putty upon the said shelves or shoulders of the rafters at the sides, and the bottom end of the slate resting upon a flat cross bar of cast iron, of the breadth of two inches or upwards, which is made with a groove, to slide along the edge of the shoulder or shelf of the rafter to the exact length the slate requires. The slate is then bedded

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Fig. 1.

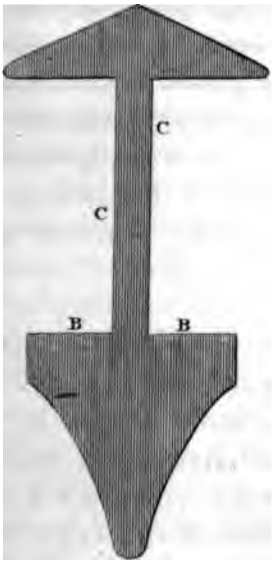


Fig. 2.

Fig. 3.

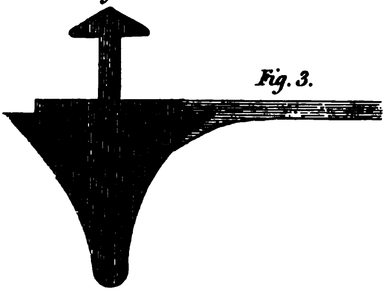


Fig. 4.

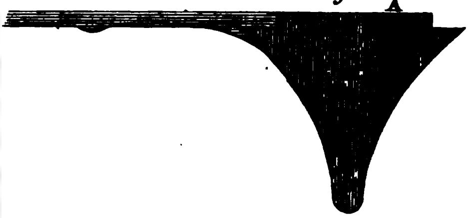


Fig. 5.

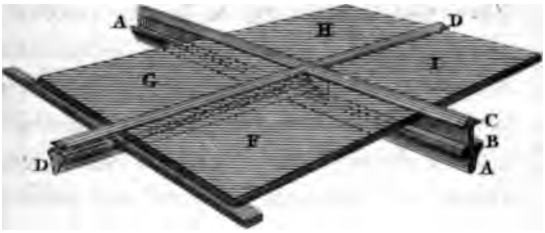
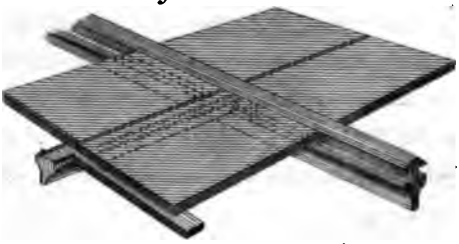


Fig. 6.



bedded in cement or putty, and pointed carefully, lapping over half of the said cross bar, and the top of the next slate lapping on the other half of the cross bar, bedded in the same manner, and there making a joint, to be secured and pointed by white lead or cement. In the shelf or shoulder of the rafter I do make in the casting, or afterwards drill, a small hole or holes; and when the slate is exactly fitted to its place I do also drill or cut a hole or holes through the slate, and drive a leaden peg, or iron nail or screw, through putty, into the holes in the slate and rafter, and clench or rivet the said peg or nail on the under side to the iron rafter or the screw by a nut, which prevents the slate from moving. I do also make two holes in each flat cross bar, into which a leaden peg, or otherwise, may be driven through the bottom of each slate, and the top of the next, wherever it may be deemed requisite for the better securing of the joint. I do also cast upon the back or top of each rafter, and which in the roof rises above the slate, a ridge or flange, which projects over the side joints of the slates, and forming a groove with the shoulder of the rafter, assists in securing the joint by protecting the putty or cement from the weather. I do also make and cast in that part of the roof which is usually called the ridge piece or pole, or first piece, upon the top or back thereof rising above the ends of the slate, and covering the ends also of the rafters, which are bolted and screwed to the ridge piece, a ridge, which projects two or three inches over the top of the slate and the ends of the rafters, and the same being well secured and pointed with putty or cement, makes any ridge, cover of lead, stone, tile, or other materials unnecessary, and gives a particular neat appearance to the roof, whilst it at the same

same time adds strength to the ridge, pole, or piece. In the said ridge piece I do make and cast, or afterwards drill, at the proper distances, which the breadth of the slate requires, two holes, through which screw bolts (by which the flange at the top of each rafter is fastened) are driven. A flange may also be cast at the other or bottom end of the rafter to rest upon the wall, or otherwise, as the design of the roof may require. In roofs upon buildings, where flatness and elegance of appearance is less an object, the sliding or flat cross bar may be spared and omitted, and the sides of the slates (which in this, as well as the aforesaid other design, should be of the largest size of sawed Bangor or Westmoreland, or other slates, and of equal width and parallel lines, (equal lengths not being material) bedded in lime or mortar upon the shelves or shoulders of the rafters, and the bottom of one slate lapping over the top of the next slate an inch and a half, or two inches, being there secured in the lapping with putty or cement, and the upper sides of the slate (under the small ridge of the rafter) pointed with putty, as before described. Or the ridge of the rafter may be omitted, and the slate meeting over the shelf, bedded in putty or cement, and secured in the same manner upon the cross bar, as before described, screwed by leaden nails or iron screws, counter sunk in the slate, and secured by putty or cement about and over the head of the nail or screw, and riveted underneath the iron rafter, as before described. The slate should be strong and large, and sawed or cut in lines exactly parallel. In each of these methods of roofing, my castings of ridge pieces and rafters, and covering with slate, may be accommodated and adapted to almost every design of building, and being framed of

materials

materials durable, and not combustible, and much less liable to contraction and expansion by effects of the weather than wood, and also from the simplicity of its construction, may be now easier kept in repair than a roof upon a frame of timber. It will be necessary occasionally to paint the iron to prevent rust or concretion, and also to refresh the putty or joints with a coat of paint; but as the occasion will not be frequent, much less trouble or expense will be incurred than in the repairs of a common roof.

And, in order that my said invention and improvements in the casting of iron roofs, and covering them with slates, may be more fully understood, I have hereunto annexed certain sketches or drawings, from which it will nevertheless be necessary to deviate, as more or less span, or extent of roof, and more or less strength, may be consequently required.

Fig. 1 (Plate VIII.) the ridge piece. B, projection of lower part of the ridge pole upon which the flange at the end of the rafter rests. C, the sides to which the said flange is secured by screw bolts through two rafters, which are opposite each other.

Figs. 2, 3, and 4, sections of rafter and cross bars.

Fig. 4, a rafter, upon which the slates (meeting upon the middle of the plane back of the rafter at A, and the ridge being omitted) lap over the iron shelf at the sides and the flat cross bar at the ends, no iron being then exposed upon the surface or outside of the roof, the slate covering the whole. When the outside of the roof is thus finished, I point all the joints within or inside the building, and complete the roof, without occasion for the lining with mortar or lime, as required in common roofs upon timber, rafters, and laths, and pegs of wood.

Figs.

Figs. 5 and 6 are respectively perspective views of the methods of arranging and fixing the rafters and slates. A, the ridge post, shewn in Fig. 1. B, projection of lower part. C, sides to which the flange is secured. D D, the rafters, as Fig. 2. F G H I, slates laid in their places on the rafters D D.

My cast iron rafters may be used along with principals, or beams of wood, the iron rafters resting thereon, bolted and secured to the ridge piece of iron, to avoid the injury consequent upon the contraction and expansion of timber by change of weather or climate. When the principals and beams are of iron, I do make and cast upon the back or top side of the principal, a shelf or shoulder and flange, a ridge similar to that upon the rafter, and it thereby answers also as a rafter. I prefer iron, not only for economy and durability, but because the frame may be removed without loss or injury of the materials, or exported to the colonies, or beyond the seas, where labour is dear, ready formed, and only requiring to be there put together. And the iron for a roof, as described, being suitable for ballast, both in weight and form, for the ship which conveys it.

And, lastly, I do declare that the forms, dimensions relative magnitudes, and other particulars relating to roofs, required to carry my improvements into effect are capable of great variations, and will require to be modified according to the purposes to be answered, and the local circumstances under which the work is to be performed; but that the said forms and other particular may, from the description and explanation I have given be determined with facility by any person of ordinary skill, and fit to be entrusted with the execution thereof.

In witness whereof, &c.

Specificatio

Specification of the Patent granted to WILLIAM MULLER, *of the Haymarket, in the Parish of Saint James, in the County of Middlesex; for certain Improvements in the Construction of Pumps.*

Dated February 12, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Muller do hereby declare that my said invention is described in and by the drawings hereunto annexed, and the following description thereof; that is to say: The nature of my invention is to raise water with less power with a pump of my construction than with a common pump, such a pump is inclosed either in a round or an oval pipe, or in two round pipes. (Plate IX.) Fig. 1, shews a section of the pump in one tube inclosed; and Fig. 2, such a section of a pump inclosed in two round pipes. An oval pipe, as *a a*, Fig. 1, should have 6 to 12 inches in diameter; the same dimensions will be necessary for a round tube; its length is about thirty feet; if such a pump is inclosed in two tubes, Fig. 2, *a a* and *b b*, then should every one have four to eight inches in diameter, and be of about 26 to 30 feet long or less. In the oval or round pipe, Fig. 1, is another of about 3 to 10 inches in diameter, and from 1 to 4 feet shorter as the one *a a*. This pipe *b b* is for the same use as the one *b b* in Fig. 2. These pipes may be made of the same length by joining them by flanges or screws. On the pipe *a a*, Figs. 1 and 2, is a head

[redacted]

o o; in the head of Fig. 1 are two bottoms *d d* and *e e*, each as when they are round four valvets; if oval only two *f*. All the valvets ought to be air tight; the two bottoms are also in Fig. 2, represented by *d d* and *e e*, in each of them is one valve. In each of the pipes *b b*, Figs. 1 and 2, moves another pipe *g g* through the bottom *e e*, air tight, its handle *g g* fastened to another bar *g g* by a joint, and this by a pin to the balance beam, *h h*, which moves air tight through the bottom *d d*. The valvets are of brass, and those in the bottom *e e*, Figs. 1 and 2, of a greater weight than those in the bottom *f*. The pipe *g g* moves in the pipe *b b*, and the lower end on four friction wheels, to keep it always in its proper situation, which should not be disturbed by any friction; the pipe *g g* may also be made of two pipes *g g*, each about three feet long, and then be joined by an iron bar *g g*, so that it always is about thirty feet from *g* to *g* or less; this pipe is about two-thirds to an inch less in diameter than the pipe *b b*, Figs. 1 and 2, and is made of the said length by screwing its pieces together; two of these pumps presented in Fig. 1, or two of them presented in Fig. 2, placed at or on one balance beam are necessary to produce the above said effect. When the piston in these pumps is moved upwards, supposing it is in its lowest situation, then will the valvets of the undermost bottom *e e* be shut in consequence of their greater weight, and the air be forced out by the valvets of the first bottom; and in moving the piston again down, the valvets in the first bottom will shut, and those in the second will open, and by this cause a vacuum between the two bottoms *d d* and *e e;* this will be filled with air out of those parts, either

either Fig. 1 between the two outmost tubes *a a* and *b b*, or Fig. 2 contained in the tube *a a* under the bottom *e e*. By repeating the motion the water will be raised up to the bottom *e e*, and the air be forced out of the pipe *a a*, Figs. 1 and 2, and at last the water will flow through the valve of the uppermost bottom, and out of the tubes *i i* into the reservoir *k k*. The force necessary to move the piston upwards is equal to the force required to lift a column of water of 12 to 24 inches high, and of the same diameter as the piston *g g*, and also the force necessary to conquer the friction and to lift the piston, which force to lift the piston however can have no action; when two pumps work together on one balance beam *h h*; the force to move the piston down the valves in the upper bottom *d d* being shut, is equal to the force to move a cylinder like the piston in the direction of its axis, which is very little, the top and the bottom of the piston terminating in a globular form, and also the force to conquer the friction, the weight of the piston having no action, as two pumps being fixed at equal distance at one balance bar. The water is by these means with about one-tenth to one-fiftieth part of the force or weight lifted or raised as is necessary to raise it in common pumps, and by applying the same power on pumps of my invention, the same quantity of water is in the same time raised ten to fifteen times as high as it can be done in the common pumps. A couple of these pumps fixed to a balance beam are worked by the same quantity of water which they will raise about thirty foot high, in letting this quantity of water fall from the height of six to ten feet, in a contrivance which will be described afterwards, and hence in this manner these

 pumps

pumps lift the water about 18 to 22 feet high, in using no other force than letting it fall from the height of six to ten feet, and so the water is raised by the pumps of my invention of no other force than that produced by its fall from the height of 6 to 10 feet, and hence can the water be lifted from 19 to 24 feet high, without any other expences than those arising from the machinery. The contrivance by which this pump can be worked consists in two such machines as now will be described, one of which is fixed with the bar *n n n*, or the handle of its piston *l l*, on the balance bar *h h*, in a distance of about 6 to 8 times as large from the supporting point as that of the piston handles of the pumps. This contrivance consists in a pipe *s s* of about 6 to 12 feet in length, and one to two feet in diameter, according to the diameter of the piston of the pumps. In this tube or pipe *s s*, moves a piston *l l*, with a valve *m* air tight, the handle of which is fixed on the balance beam in the above said distance from the supporting point *t*. As soon as the water flows out of the pumps through *i i*, it is collected in the reservoir *k k* through which bottom are one or two holes with valvets *g g*; between those two valvets *g g* is a hole *n* with a pipe *n n* on it, that the piston moves without any friction through the bottom of the reservoir *k k*. When the piston *l l* is in its highest situation Z Z, then the two valvets *q q* will be opened by the two bars *p p*, and when it is in its lowest situation, then its valve *m* is opened by the bar *o* fixed at the bottom of the pipe *s s*. When two of these contrivances contained in the tube *s s* are fixed at or on a balance beam, one of them at each end in the said distance from the supporting point *f*, then will

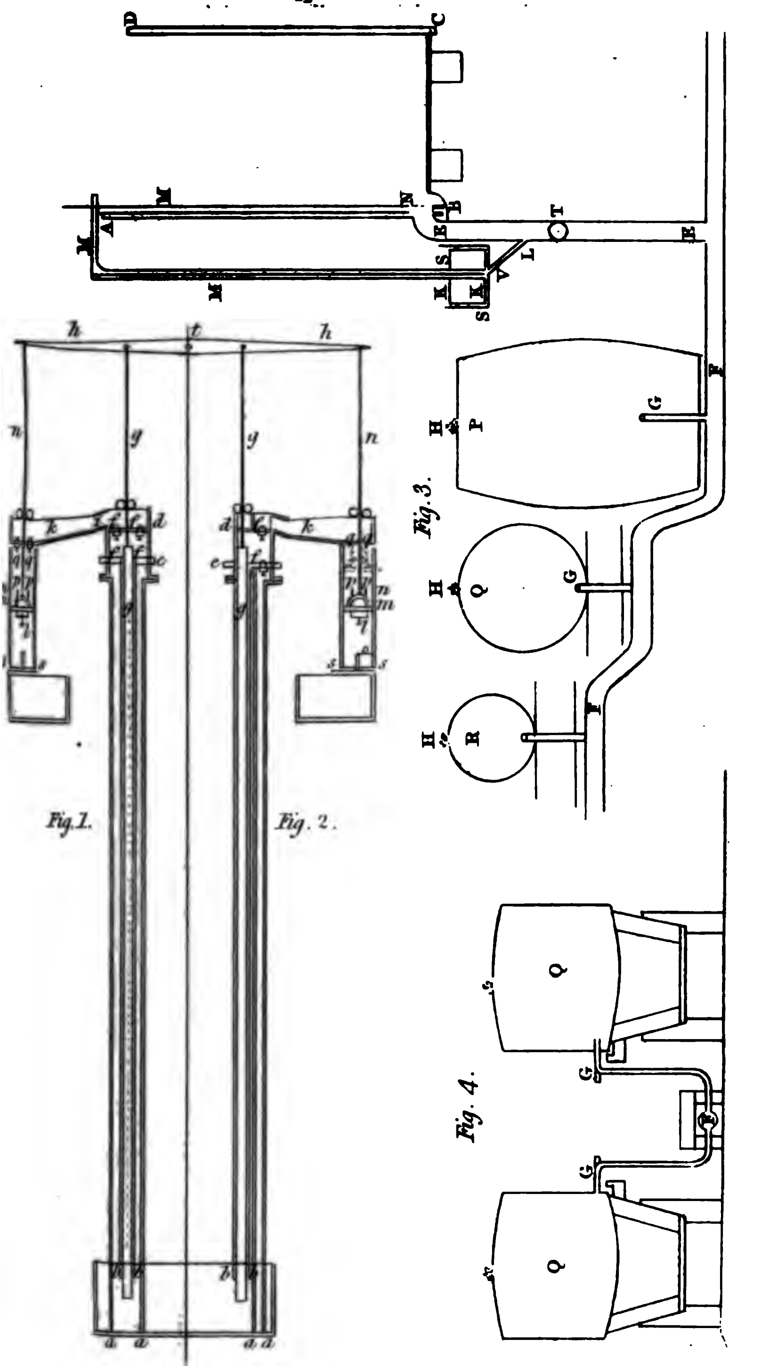


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.

[redacted]

will one piston be in its lowest situation, whilst the other is in its highest situation, as the pointed line Z Z shews, and then will this tube be filled with water through the valvets *q q*, and at the very same time will the other tube whose piston is sunk down to its bottom be evacuated by lifting its valve in by the bar *o*, then will the piston in the empty tube rise, and the one in the filled tube sink; and so this motion will reciprocally be repeated by the gravitation of that quantity of water lifted by the pumps, and the balance beam will thus be moved, which again will put the pistons *g g* of the two pumps in motion; and hence will the pumps be moved by the very same quantity of water which they lift in letting it fall from the height of eight to twelve feet.

In witness whereof, &c.

Specification of the Patent granted to JOHN GREGORY, *of Islington, in the County of Middlesex, Builder; for a Method of tunning and cleansing Ales and Beers into Casks.* Dated March 22, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Gregory do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say:

In the drawings, Figs. 3 and 4, (Plate IX.) hereunto annexed, the letters A B C D denote the square, or round, or cleansing back, or other vessel in which beer, ale,

[redacted]

ale, or worts is supposed to be in readiness for tunning after having passed through the first stages of its fermentation. E E is a pipe through which the fermented liquor is conveyed by a main pipe F F and branches G G into any number of buts, barrels, or other vessels P Q R (which act of drawing off or conveying is called tunning or cleansing). S S is a vessel into which part of the fermenting liquor, from the before-described vessel A B C D, is admitted through L, and serves to support a float K K, which rises and falls with the liquor, and, by means of the arm, branch, or beam M M M, which is properly supported, raises and lowers a sluice or sliding piece N; to the effect, that when the float K K is considerably raised, the sliding piece N shall shut off the communication through E, and contrarywise when the float K K is suffered to subside, the sliding piece N shall afford less obstruction, or leave the passage through E quite open.

And I do farther declare, that the said passage through E may be opened, shut, or obstructed, by the action of a float in S S operating upon a cock in the manner of what is called the ball-cock; and that a like effect may be produced by various other well-known contrivances. The buts, barrels, or vessels P Q R aforesaid, are so placed, that the respective bung-holes H H H shall lie in the same level or horizontal plane, or nearly so, as the surface T T, at which the liquor in the vessel S S will stand immediately previous to, or at the time when the float K K shall by its ascent completely shut the opening through E; and the object or conseqence of such disposition or placing is, that the liquor from the before-described vessel A B C D will flow through the pipes E F into the buts, barrels, or other vessels P Q R, so as completely

to fill them, and no more, and will prevent any om lodging in the upper part of the said buts, and other vessels.

I do farther declare, that my said invention or produces the advantage of a very considerable of labour in tunning or cleansing ales or beers as d, and is calculated to produce a much cleaner, nd in other respects more valuable article, be- ng liquor is introduced without that mischievous of agitation which takes place when the same is in at the bung-hole by the common method, and the yeast, not being suffered to remain stagnant ie surface of the liquor in the cask, is not liable ibsorbed upon any change of the atmosphere, s well known to produce injury, foulness, and a sour, by exciting a second fermentation, and other ir processes in the same. T is a cock in the pipe r the purpose of shutting off the communication, pending the operation of tunning whenever the ay be necessary or convenient, and more parti- when the tunning is compleated; and V is ano- ck for admitting the liquor into S S, to give effect loat K K, as before described.

itness whereof, &c.

The

The Fifth Year's Account of the Produce of Milk and Bu-ter, &c. from a Cow, the Property of Mr. WILLI CRAMP, *of Lewes, in the County of Sussex, for this l Season, commencing April* 3, 1809, *(that being the D she calved,) up to May* 8, 1810, *a Space of* 57 *Weeks.*

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

BUTTER.	No. of Weeks.	Pounds per Week.	Quantity of Butter.	Sold at per Pound. s. d.	Total Value. £. s. d.
Twin calves at nine weeks old sold for six guineas each	—	—	—	—	12 12 0
From the 6th June to the 3d July	4	17	68	1 6	5 2 0
From the 4th July to the 18th Sept.	11	16	176	1 6	13 4 0
From the 19th Sept. to the 13th Nov.	8	14	112	1 6	8 8 0
From the 14th Nov. to the 25th Dec.	6	12	72	1 6	5 8 0
From the 26th Dec. to the 26th Feb. 1810	9	10	90	1 6	6 15 0
From the 27th Feb. to the 23d April	8	8	64	1 6	4 16 0
From the 24th April to the 30th April	1	7	7	1 6	0 10 6
From the 1st May to the 7th May left off milking	1	5	5	1 6	0 7 6
	57		594		57 3 0

MILK.

	Quarts per Day.	
From the 6th June to the 3d July....	24	672
To the 18th September	22	1694
To the 13th November........................	18	1008
To the 25th December........................	14	588
To the 26th February 1810	12	756
To the 23d April..................................	10	560
To the 30th April	8	56
To the 7th May	5	35
		5369
The milk being measured when milked from the cow, there must be deducted for cream		594
Total........................		4775

4775 quarts of skim-milk, at 1*d.* *per* quart..........19 17 11

Value of new Milk, exclusive of what the Calves sucked.

	£.	s.	d.			
From the 3d April to the 9th April 10 quarts *per* day, 70 quarts at 5*d.* *per* quart	0	17	6			
To the 23d April 8 ditto 112 ditto....	1	8	0			
To the 7th May 6 ditto 84 ditto....	1	1	0			
To the 21st May 4 ditto 56 ditto....	0	14	0			
To the 4th June 3 ditto 42 ditto....	0	10	6	4	11	0
Value of dung made this season........................				3	0	0
				84	11	11
Expense deducted, as in my last year's report				24	14	2
Profit				59	17	9

 The

The management of a large dairy (after the plan which I have laid down) may be attended to in most of its rules. Grains seem to be the greatest obstacle. I will suppose they are not to be had at all; seven months in the year they are not wanted, as every kind of artificial food can be had in great plenty, giving a little sweet hay once a day, to keep them in a regular state. In the winter time there may be provided turnips, cabbages, and potatoes; the two former will no ways affect the milk and butter, if given moderately twice a day: carefully avoiding giving them rotten and withered leaves, and giving them plenty of sweet (green saved) hay, they will (no doubt) do much better than ranging abroad in the cold hungry fields, labouring and fatiguing themselves for food, injuring the land, and thereby occasioning great loss of manure. * Thirty acres of land would be sufficient to produce food enough for forty dairy cows, (if properly managed,) including for hay; whereas, in the common mode of feeding, thrice that number of acres would not do, and they would not produce above half the quantity of milk and butter. I think salting hay, when made into a reek for milch cows, would answer a good purpose. If salt could be had reasonably, about 20lbs. to a ton of hay, shaken regularly over every layer by the makers of the reek, would cause thirst, and thereby increase milk. The quantity of food milch cows will consume is not easy to ascertain; they should have sufficient, but not to commit waste. Cattle should not be over fed, so as to be surfeited; little at a time, and they will eat their food clean. I feed my cow six or seven times a day.

* Something more or less: much depends upon the quality of the land, and management.

In

In my statement this season, I have given no account of milk farther than up to the 7th May, although she was milked up to the day before she calved (*she would not go dry*); but the milk being brackish, was fit for no use but the hogs. I do not perceive the least injury she had sustained by it; her milk came with the calves, and as soon and as plentiful as if she had been dry for two months, and her calves in good and lusty condition. She is now in as great perfection for the dairy as in any former season. It will be observed, my cow produced a greater quantity of milk this season than any former one, but not a greater quantity of butter: that I cannot account for: it may be, the having twins: nature ordered it so, that they might be sufficiently supplied. It will be also observed, she produced a great quantity of milk, besides what the calves sucked; and why not make butter? The trial was made, but in vain; the cream produced was small in quantity, and poor; and every trial made to make it into butter, for many hours, was to no purpose. This strange circumstance I am quite at a loss to account for, as I always milked her myself, sometimes before the calves, and at other times after, but the milk I got produced no cream sufficient in quality to make butter.—Query, could the cow have a power of withholding the cream part of her milk from me; or could the calves have an art of sucking it.

Method of converting a common Ship's-boat into a Li boat. By the Rev. James Bremner, *Minister of Wa and Flota, Orkney Islands.*

(Concluded from Page 117.)

THE before-mentioned process is to be followed in the casks aft, where the dimensions of the boat will a mit of it, and where otherwise one large cask rathe ship may be used. It was in this manner that the e periment at Leith, hereafter to be detailed, was ma and all the cork that was used on that occasion was ab one hundred weight, put into the narrow part of boat aft, in order to raise a common porter cask, plac above it to a convenient height. The preparation of t cork bundles in this case will differ somewhat in th shape from those in the former plan; but as the p pose of them is the same, namely, to fill up the vac spaces betwixt the cask and the boat, a particular d scription of them seems quite unnecessary; only, it m be observed, that as the diameters of the cask form are considerably less than that in the former plan, so mu of the cork ought to be placed underneath as may se to raise the upper side of the cask about four inc above the gunwales, it being evident that the hig they can be raised with sufficient security, the more fectually all possibility of overturning will be prevent

The same quantity of ballast is to be used in t case as in the former, and is to be applied in the sa manner.

With respect to boats of small vessels, a single c forward and another aft, without any cork, will be s ficient.

E

Each cask to be about the size of a hogshead, and to be set on end, or leaning obliquely towards the rings in the stem and stern, to which they are to be secured, and at the same time to two other rings placed in the keel, proper for that purpose: these casks, from their position and power, would effectually prevent sinking or upsetting: and as the crews of such vessels are few in number, their boats might support them safely through any breach into shallow water.

The foregoing plans are founded upon unquestionable principles, and constructed according to a regular method. They keep in view the difficulties to be encountered, and provide against them by making a few necessary preparations in due time.

Were this attended to, all the confusion and embarrassment which arises from sudden alarm, and the distress that must attend a total want of suitable means, would be prevented, and an encouraging prospect of safety held out even in the most perilous situations.

The want of timely forecast, and the neglect of means that were in our power, never fail to occasion the bitterest self-reproach, and the most painful vexation, whenever we are overtaken by misfortunes, which a little prudence might have prevented.

Having, however, but too much reason to apprehend that such prudential provisions as have been stated will still be neglected, in spite of every suggestion and consideration that can be urged, I shall now propose a third plan, which, though inferior to the former, as a ship with jury masts, torn sails, and a temporary rudder, is to one in perfect good condition; yet, considering that this inferior plan, like the disabled ship, may gain what was despaired

despaired of, and save what was given up for lost, I proceed to state it:

This plan will consist in the application of casks only. These, if stowed closely, and so as to fill up as well as possible one-third part of the boat forward and one-third aft, would effectually prevent the boat from sinking or oversetting.

Upon this plan, in order the better to secure and combine the cask, the end of a sail should be in the first place thrown into the bottom of the boat, and the cask being stowed upon it, the other end of the sail should then be doubled over all: the seizings are then to be made through holes struck any where through the bottom and sides, wherever the passing of a rope may be found necessary, or of any use for confining the cask.

The constant and general idea, that the utility of every boat depends upon the tightness of her bottom, and her completely resisting the admission of water, opposes itself strongly, and almost irresistibly to the directly opposite idea, that water freely admitted could do no injury; nay, so strong is the received opinion, that it may be very difficult to persuade some, that large openings in the bottom would prove a real advantage; it is, however, undoubtedly true, that, in the present plan this would really be the case.

It is, therefore, very material to observe, that neither the number nor the size of the holes struck through are of any consequence as to the water in the boat; on the contrary, they would be so far from being detrimental that to a certain extent they would be of advantage, as they would serve to discharge, in proportion to the buoyancy contained, whatever top-water might be within

side

side, above the level without, and which the boat would otherwise retain as a load and dead weight, if she were every where perfectly tight: whereas, in proportion as the buoyant power operated in raising her, the top-water would instantly subside through the holes in the bottom, and thereby render her more lively, and to swim higher out of the water.

From not attending sufficiently to the fact now stated, it has probably happened, that the plan we are at present describing has never been attempted; but whoever will take the trouble to consider the matter for a little may soon be convinced that they may, *without scruple or hesitation, make as many holes, and of whatever size,* as they may judge necessary for passing ropes, wherever they can serve for effectually securing the casks in their places.

The only point chiefly to be attended to, is never to attach ropes to any tender part of the boat, such as the gunwales or thwarts, but to such parts as possess the greatest strength, and in which entire confidence may be placed.

As the largest boats have strong timbers, this plan might probably succeed best if applied to launches and long-boats.

Small anchors that have iron stocks, and which could be laid in the bottom of the boat, would serve for ballast; though probably ballast in large boats would not be very necessary.

The holes to be struck through may be pierced with a marling-spike and mallet betwixt the timbers.

The power and effect of empty casks is well known, the application of them being a common expedient, used

almost

almost every day for the purpose of floating stranded or bilged vessels of great burthen.

How easy then it must be, by the same means, to render a boat buoyant to any degree that could be wished, may be abundantly evident to every person not obstinately blind to undeniable fact.

The thing is so self-evident as to require no proof, that if both ends of the boat be tolerably filled with empty casks, she will not only thereby be secured against upsetting or sinking, but will be rendered extremely buoyant, provided the casks be effectually secured in their places; and in full proof of this fact, the experiment hereafter to be narrated, was made almost entirely with empty casks.

The inventor having little hope that the far better and more eligible plan by timely preparation will be adopted, is the more solicitous to gain attention to this third mode, by means of casks only, because necessity, which is often the mother of persuasion as well as of invention, may compel the unfortunate mariner to have recourse to it.

Seamen being above all others expert in the use o ropes, and expeditious in making secure seizings, which is the great and only thing wanted, the inventor beg leave confidently to affirm, that whenever it shall b tried it will be found perfectly safe and successful.

Let, therefore, no scruple or hesitation be made i striking holes through the boat any where, and of an number or size that may be found necessary for passin ropes for the effectual confinement of the casks. Th plan will apply *not to one boat only, but to every boat in th ship*, provided there be a sufficiency of casks on board.

If then the two great points upon which I set out, namely, the powerful buoyancy of cask, and the peculiar expertness of seamen in every operation where ropes are to be used, be duly considered, they will sufficiently vindicate and verify all that I have stated; and unless the one or the other, or both, (that is, the power of cask, and expertness of seamen) can be shewn to be false assumptions, the conclusions which I have drawn, can neither be denied nor resisted.

Observations and Remarks relative to the foregoing Plans.

1.—From the detail in the description it may be alledged, that the situation would not admit of so much time as the preparation would require.

It is granted, that in some cases this might be true, if nothing had been done before hand; but surely such neglect ought by no means to be imputed as any defect in the plan, but ought to be ascribed to its true cause, the remissness of those who would give themselves no trouble to avail themselves of it.

Slings fitted to the cask, two additional ring-bolts, two augur borers, and the requisite quantity of cork, are all things so trivial and so easy to be provided, that to be without them must appear an unpardonable neglect, and if these were in readiness, the short space of ten minutes would be quite sufficient for laying them in their places, and securing them.

It is evident to demonstration, or it might be easily proved by experiment, that with respect to the two first methods stated, and where the necessary provisions had been made, that the whole could be executed in ten minutes, and therefore any objection in point of time can have no place.

 2.—When

2.—When there is a prospect of the ship holding together for some time the boat may be kept in readiness and in reserve, or may be served on shore by a rope, and hauled off again, as often as occasion may require; and if to be hauled off, it might be a necessary precaution to pass a rope round her lengthways to assist the ring-bolt in the bow, and in every case the attachment and connection of the boat with the vessel ought to be well secured till the moment she is to be cast off for the shore.

3.—It is of no consequence in what manner this boat is to be got into the water, whether after-end or side, by means of handspikes or otherwise, as no water can hurt her, though it might be more desirable if it could be done without filling her in midships, as in that case she might be conducted through very heavy seas without filling at all, or receiving more water than might be easily baled out.

4.—It is material to remark, as it may not generally be attended to, that the plan always supposes the midships to be full of water; but that the requisite buoyancy of the boat is not injured by that circumstance, nor will the addition of people, in so far as they are immersed in the water, prove any additional burthen; this will be perfectly clear to all who understand this part of the subject, however improbable it may appear to others, and the remark serves to shew that it would be a good rule, in such circumstances, for the men to keep themselves immersed in the water in midships as far as possible.

The idea of placing men in the midships of the boat whilst at the same time it was full of water, would probably startle a landsman not a little; such, therefore, may be

[redacted]

be told, that every life-boat is supposed full of water, and that to imagine there could be any man in one with a dry thread about him would argue a total ignorance of the matter.

5.—It is to be kept in mind that the danger is always supposed to be extreme, and that the present plan affords the only possible chance of saving life; therefore, whatever hardship or difficulty there may be in putting it in execution is entirely out of the question; any other view of the subject is altogether foreign to the purpose.

6.—If any are of opinion that cork ought alone to be used for buoyancy, there can be no doubt of its answering the purpose perfectly; at the same time the author is of opinion, that a combination of cork and cask would be found more convenient, and in some respects preferable.

Water-casks would always be at hand, and to save the expense of cork might on that account be preferred by some; but, independent of this consideration, casks are by more than one-half lighter than their bulk of cork, and thereby more than a double advantage in favour of buoyancy is gained by using them.

There is but one objection to the use of casks, and that is, that they may be stove in; but if the great strength which they possess from their construction be considered, and at the same time that they are strongly defended by the boat, this objection must appear of no moment at all.

7.—Every boat prepared as has been stated is fit to carry men equal in weight to something more than one-third of the boat's whole burthen, and one of eighteen feet in length can carry from fourteen to sixteen people,

and have sufficient room for working a pair of oars, which ought by all means to be short ones.

The disadvantage of working long oars upon a low gunwale, and in a high running sea, is too obvious to need any thing more than to be just mentioned.

8.—As all depends upon the points of fixture, too much attention cannot be paid to their sufficiency, and though those stated in the plan are judged to be perfectly adequate to the purpose, yet any person wishing for more, *may add them at pleasure*, by rings of rope in the stem and stern-posts, as in the Greenland boats, by more rings in the keel, or, in addition to the seizing-ropes, a netting of small rope may be made to cover the whole forward, and another such may be applied in the same manner aft, and by these means every possible security that can be desired may be obtained.

9.—It is material to observe, that no dependence ought to be placed on seizings connected with the thwarts or gunwales, unless it were only as aids to the points of main dependence.

The gun-wales, more than any other part of the boat, are liable to damage, and may very possibly be injured in hoisting out, or before getting clear of the vessel.

The two augur borers in the keel are infallible holds; easy access may be had to them while the boat is on deck, and a rope may be passed through them in a moment.

This seizing, besides the security it affords for confining the buoyancy, adds considerably to the strength of the boat, and therefore ought to be preferred to any other mode of fixture.

10.—No rule can be laid down that will fit all boats, as to the precise quantity of cork, or size of cask, their shape

shape and dimensions being so various; but from the general rule that has been stated, and the purpose to be served, every man may easily adjust his apparatus to his boat, or make such little alterations on the boat as may be found convenient or necessary.

11.—No sail can hurt this boat, as it is supposed she has only to go right before the wind, and therefore a sail may be used with very great advantage. This would render oars unnecessary, and would be infinitely preferable. It is almost needless to add, that the boat could be steered in midships.

12.—The great benefit derived from the common life-boats is well known, and universally acknowledged; but they are very far from being adequate to the calamity they are intended to remedy.

Their number comparatively is very few, and the sphere of their operations extremely limited.

In darkness by night, and in thick snow by day, when their aid is most wanted, they are of no avail.

Storms may blow, and sometimes have blown so hard as to defeat their utmost exertions, and even in the most favourable cases, require a considerable time before they can reach the wreck; in the mean time the vessel may be dashed to pieces, and all hands lost.

The very pre-eminent advantage of the ship-boat in these and several other respects is very conspicuous.

This boat is wherever the ship is, and recourse may immediately be had to her; is of equal utility by night as by day, and in the thickest as well as in the clearest weather; and whilst the life-boat, with extreme slow progress, must be impelled against wind and sea by a force superior to both, the ship-boat has only to drift with ease before the storm.

13.—As

13.—As it may serve to gain confidence with those who are not otherwise qualified to judge of the plan, it may be observed, that the ship-boat is prepared upon the very same principles as the life-boat, and that these principles are applied to greater advantage in the former than in the latter. The quantity of buoyancy in the ship-boat, being considerably more in proportion to her size, and being carried to a greater height, gives more security against oversetting; and if to these advantages there be added the far greater one, of having only to drift before wind and sea, no shadow of doubt remains of the success of the ship-boat over that of the other.

Lastly.—This plan carries with it the very strong recommendation of private interest as well as of public utility.

Suppose a ship to be riding in an open bay or roadstead, a storm comes on, and if in winter, a long dark night is soon to follow.

In this situation the mariners being extremely doubtful whether the vessel could hold it out over the night, and terrified at the awful prospect of being thrown, as it were, blindfold into the most perilous of all situations, the determination would most undoubtedly be to cut and let the ship on shore while there was light, as giving the only chance for saving life.

The same determination may be taken in hopes of escaping by favour of a falling tide, and in both cases lives, ship and cargo may be all lost, as has certainly very frequently happened.

Whereas could safety be ultimately relied upon from the boat, the ship would be allowed to ride so long as anchors and cables could hold her, and in the mean time the storm might abate, the wind might shift, or her tackling

tackling might prove sufficient to outride the storm, and thus lives, ship and cargo would all be safe.

In every situation the prospect of safety by means of the boat, would prevent every precipitate measure, and encourage men to make those exertions for saving ship and cargo, which are not to be expected from men despairing of life.

In the foregoing plans there is nothing that can be reckoned complex, nothing that requires nice adjustment, or of doubtful and precarious effect.

They are unquestionable in principle, simple and easy in execution, and absolute in security; and if the necessary previous preparation, which is very little, has been made, they will be found as expeditious as any emergency can require.

They have been proved by experiment as far as circumstances would permit, and have received the unqualified approbation of naval men of the greatest experience, and of the first respectability.

These are the solid grounds upon which they are offered to the public in general, and most earnestly pressed upon the attention of seamen in particular.

The plan having been communicated to hundreds of seafaring men, they have always given it their ready and entire approbation; hence it is hoped, that every seaman from his own knowledge and experience, without any doubt whatever, will, upon considering the subject, be fully convinced in his own mind that the scheme is perfectly practicable, and if adopted, would be attended with the happiest effect.

Deeply impressed as I am with the importance of the subject, I shall be forgiven if I again repeat it, that shipwreck presents to our view distress heightened by

every

every circumstance that can awaken sensibility, or excite commiseration.

To be exposed to the shock of overwhelming waves, —to contend long in one continued struggle for life,—to be bereft of every hope,—and given up to despair; constitute the deepest affliction in body and mind that human nature can undergo.

In this situation oft does the sufferer wish (which some who have narrowly escaped declare) to give up the painful contest; but nature refuses to resign, and keeps her hold so fast, that sometimes death itself has not been able to disengage it, for friends after death have been found fast locked together in each other's arms.

If this subject be considered in a political view, it must strike every mind, that the preservation of the lives of our seamen is united with that of our independence and very existence as a free nation.

Our seamen are the bulwark and palladium of our lives and liberties, and upon them alone, under God, depend all our greatness as a maritime power, and all our prosperity as a commercial people.

The ocean is their element, and every region from the vertical sun to the frozen pole is alike the scene of their diversified labours and manifold dangers.

Those necessaries, conveniences and comforts of life which nature has scattered widely throughout the terraqueous globe, they collect, transport and exchange, to the great benefit and general advantage of the human race.

It is to them that Britain stands indebted for the traffic of all nations, the wealth of both Indies, and the empire of the ocean.

The glorious victories they have lately achieved, and by

by which they have annihilated the navies of Europe—their skill—their courage—their fidelity, have justly merited all the applause, gratitude and rewards, that their country can bestow. Would it not then be culpable—would it not be criminal, to leave unattempted any means that have even the smallest probability of being useful in preserving the lives of so valuable and important a part of the community?

The regular plan which has been stated (to say the least of it) holds forth a very probable means of saving, annually, several hundreds of able and experienced seamen, and consequently would, in a very few years, furnish a reinforcement of thousands to our naval strength, and that too from a resource altogether new and unlooked-for, and at the same time without any trouble or expense.

Substitutes and Expedients which may be found useful.

1.—If so much cork was made up in canvass as would serve to go quite round the boat withoutside, and reach from the top of the gun-wales to about fifteen inches downwards, and of one foot in thickness; the same might be attached to the boat, and would render her extremely buoyant. This, together with ballast, and a small quantity of cork withinside, would render a perfect life-boat, upon almost the very same plan as the present life-boats.

The cork might be made up in so many separate parcels, (netted in small rope,) as was found convenient to be attached to a strong rope going round the gun-wale, and to another such which ought exactly to fit the girth of the boat where the cork reached to below.

As the cork would only press upwards, and always against the bottom and sides of the boat, it is evident that if the lower rope fitted tightly, the cork would keep its place; and in order to secure that point a few turns of rope passing from the lower edge on the one side over the keel to the lower edge on the other side would fix it completely. A very few seizings attached to the gun-wale rope passing from the one side to the other would be quite sufficient.

The separate parcels must be furnished with loops or ends for attaching them to the main ropes, and to one another.

2.—Several ring-bolts might be put into the keel withinside, and ropes, single, double or treble, might be passed through these rings before laying in the buoyant materials, and then these ropes might be brought round the whole contents and made fast.

3.—It frequently happens that seamen, after they have gained the shore, find they have only escaped one death to perish by another still more miserable.

Drenched in water, chilled to the heart with cold, worn out with fatigue, and exposed to all the severity of inclement weather, without shelter or succour, it is impossible but that the remains of life must soon be extinguished.

In this situation, and it is far from being uncommon, dry clothing would be as precious as life itself, and it might be by the following expedient:—

Let a *leathern* bag be made for containing some shirts, a waistcoat or two, and two pair of drawers, all of flannel.

Let this bag be made of a length and size convenient for the purpose, and for tying round under the arm-pits.

This

This would serve the purpose of a cork-jacket in the water, and prove a second time as life from the dead, by affording dry and warm clothing upon gaining the shore.

By this expedient every man may be made a swimmer, and sometimes one man by swimming has been the means of saving the whole ship's company.

It may be proper to observe, that the larger part of the bag should be placed high upon the breast, and the other or back part no higher than the arm-pits, as in the act of swimming, the back part of the shoulders is little more than just covered with the water.

The bag must be perfectly water-tight, and only moderately filled; both ends of it may be left open to be closed with a tight seizing of small line.

The expense of this preparation would hardly cost five shillings.

4.—If it were intended only for swimming, a neat and commodious preparation might be made with cork covered with thin leather, to be applied in the manner which has just been described.

It might be fitted on with clothes or without in half a minute, and made fast by a knot or clasp on the breast; three pounds of good cork would be sufficient to support any man, and the expense no more than in the former case.

5.—Another expedient bids fair for obtaining a speedy communication betwixt the ship and the shore, by means of a kite.

It is the property of this machine, to ascend in proportion as the cord is spared off.

To manage this, and to bring the line within reach on shore, let a piece of light wood, about the size of a

small handspike, be attached to the line, about twelve fathoms from the kite; the line to be fixed to the fore-part of the stick, and so as to pull only there, and then being slackly laid along the stick, made fast to the other end: by this means the kite would be prevented from rising higher, and would at the same time bring the line to the shore from the ship, and by this small line a rope might be hauled from the ship by any spectator on the shore.

A silk handkerchief, and a piece of wooden hoop, might soon furnish a kite.

6.—Sometimes people are seen to perish, where those on shore, and those on the wreck, are almost within grasp of each other.

In this case, if there happened to be a mast standing, a common ensign made fast to a stick, just strong enough to keep it spread, and quickly spared off from the mast-head, would probably reach the shore without touching the water, or at least drift on shore with a small line attached to it.

No experiments having been made upon these substitutes and expedients, they are barely mentioned, as things that might possibly succeed, and are thrown out as hints for others to improve upon, after much consideration on my part.

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On Hay-making in general, and particularly in Wet Weather. By Mr. JAMES MILNER, *of Scortan, near Catterick, in Yorkshire.*

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

THE various treatises that are extant on this subject seem to be written by gentlemen farmers, who have not had sufficient manual practice in the art, or by practical farmers, who are in general deficient in writing in a clear and scientific manner on the subject, though very conversant and knowing in practice.

As I have had very extensive practice for near fifty years in the art of hay-making, and have paid great attention to the various methods made use of in all the northern counties, in some of the midland ones, and also those near the metropolis, I may lay a claim at least to experience, resulting from a variety of observations, trials, and comparisons.

I shall now proceed to give an account of hay-making as it is practised in Wensley Dale, a valley situated about fifteen miles south-west of Richmond, Yorkshire, nearly twenty miles in length, and five or six on an average in breadth, where the soil for pasture and meadows is extremely rich; land there fifty years since let at two pounds a statute acre, though far from any good market town.

Respecting the cutting of grass, the method is nearly the same throughout Great Britain; but good practical farmers prefer cutting it very low rather than highish, because they say it vegetates much sooner, and grows much quicker, after low-cut grass than high-cut; the crops therefore of both the hay and after-grass will be greater.

greater. The day after it is cut in Wensley Dale it is strewed with the hands in such a regular and even manner that no sops or lumps of grass appear on the surface. Neither forks nor rakes are used in this part of the work, except where the grass is very light indeed. This method requires industry and care, but when it is well executed the hay is half won. The next process, the day after, if the weather be fine, is to turn it with the rake-head, in a very neat and regular order. The day after, if the weather be fine, they put it into hand, or lap-cocks. One raker, man or woman, for both are expert at the business, goes before a cocker; each cocker takes up about ten or twelve pounds weight of hay, shakes it up very lightly, then puts one hand a little under it, and the other on the side of it, takes it up and sets it down again gently where it is clean-raked, in a neat regular row, leaving an aperture or hole about the middle in the side of the cock, so as to admit air in case of wet weather; always making them even and smooth at the top. Cocks made well in this manner, will, on account of their lightness and smoothness, certainly repel the rain, and throw it off better than any large cocks, heaped up carelessly and hastily, as they generally are, with the rake or the fork; besides, in wet weather they dry considerably sooner, on account of their lightness and good shape, and will stand better than larger made cocks, even in windy weather. This seems rather paradoxical, but it is a certain fact: for when the wind takes hold of a larger badly made cock it will sometimes hurl it into the air, and perhaps carry it into another person's premises, whereas the small well-made lap, or hand-cock, remains in security, receiving very little damage, though it has stood the blasts of several tempests. This part of

hay-

hay-making, I am fully persuaded, from long experience, and a variety of observations in different counties, is preferable to any I have ever yet seen.

The farmers consider the hay in this state, *i. e.* in good lap-cocks, as nearly won, and will never venture to spread it about again, though it wants a little drying or hardening, till they see the greatest probability of a fine day, when they again, if the prospect be favourable, about eleven o'clock, spread it out regularly with the hands in the same manner as strewing it; it is then tedded, or put into rows, and carried in sledges to be stacked. Taking it off the ground in sledges is not perhaps so ready as sweeping, but the sweep injures the hay much more by the different lumps or rolls of hay that it has collected, which very frequently mould, and injure several parts of the stack or rick.

The Wensley Dale farmers likewise are superior in point of making their ricks, &c. They seldom make long ricks, as in the South, but round ones, nearly cylindrical, till they are about two-thirds of its height; then a conical form takes place; then the rick is carried up to such a regular point, and roped so closely and nicely, that neither wind nor water can penetrate: in short, the ricks are less injured by time or tempest than those that are covered with straw, which is the common practice in most counties. The reason is evident, because the stacks that are covered with straw are seldom carried regularly to a top; they are generally too broad there, and the straw is then laid on very injudiciously, and without method: the rick, consequently, in time takes water, and a considerable part of it becomes putrefied litter. By the carelessness of servants, and the want of a judicious and philosophical knowledge in most farmers respecting

respecting the form and finishing of ricks, their losses cannot but be considerable. The true figure of what is generally called a round stack, or rick, is at the bottom part the lower frustum of a spheroid: nearly at the middle the diameter is about one-eighth greater; then it is gradually raised, and finished in a neat conical manner. Perhaps it may be asked, why the Wensley Dale farmers are so celebrated throughout all the northern counties for hay-making? Wensley Dale is, perhaps, one of the worst situations in England for winning hay soon, being totally surrounded with high hills; that on the South is the noted Penny Hill; and there is another called Wherring-side, at about one mile distance from it, thirteen feet higher, though seldom mentioned in history. These hills powerfully and frequently attract the clouds, which cause considerably more rain to fall there than in a level champaign country. These disadvantages, added to a great desire of winning their hay crops well, as they have very little corn, long since incited the farmers to pursue various methods, and to make comparative trials, till at last they decisively and justly concluded the present method eligible and preferable; and by the invariable practice of which they acquired their acknowledged and merited celebrity in hay-making. It will be hardly credited, perhaps, when I say, that fifty years back the men received there for their daily labour two shillings and sixpence, the women one shilling and sixpence, and the boys and girls, from ten to fourteen years old, one shilling each, including their victuals, which in the hay-harvest were always good, and in great plenty; for they eat no less than five or six times a day; this fully shews their peculiar attention both to their labourers and hay-harvest, and also

also their wish to excel in the art. Their working hours in Wensley Dale are certainly longer than in most other places; but when people can and are willing to work long hours, they undoubtedly merit extra wages, and both the master and his labourers are ultimately and mutually benefitted: for it is a general and just observation, that if hay be neglected, and not won in proper time, a considerable part of its nourishing qualities will be greatly injured, and consequently incalculable losses sustained. In dry weather, where the grass was very heavy, I have often seen hay, by stowing and cocking it in the above manner, won two days sooner than other farmers have won theirs, who were careless, and followed no regular plan in these two principal points, stowing and cocking; and I have moreover seen, particularly in long wet weather, hay made in this regular and, as it were, philosophical manner, won sooner by three or four days than by any other process whatever.

On Wheel Carriages.

By Mr. BOOTH, *of Allerton, near Liverpool.*

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

I HAVE read two Reports of the Honourable Committee of the House of Commons, dated the second and thirtieth of May last, on the use of broad wheels, and on the preservation of the turnpike roads and highways of the kingdom, and it appears to me that they have not gone to the root of the evil; nothing short of the absolute prohibition of narrow wheels, except for gen-

 tlemen's

tlemen's carriages (respecting which I shall offer an observation or two below) can effectually obtain the object in view, good roads, at a moderate expense. The total exclusion of narrow wheels is the *sine qua non* in this business; and, by adopting this principle, I shall shew that good roads may be produced, and kept so, at a moderate expense, not only to the infinite benefit of the public, but to the real advantage of the proprietors themselves of carriages of all descriptions, notwithstanding their restriction to the use of broad wheels solely, and that weighing machines will be totally unnecessary. The use of any wheels less than five inches in breadth ought to be strictly prohibited, as it may be clearly proved that it will be the real interest of proprietors of waggons and of carts of all descriptions, that no wheel in either ought to be of less breadth than five inches. To demonstrate the truth of this position, let us suppose the wheel of a one horse cart to be four feet and a half high, three inches broad, and the tire five-eighths of an inch thick; the weight of this tire will be eighty-nine pounds and a half, and the tire of both wheels double, or 179lbs. Let us now suppose a wheel of the same height, but five inches broad. It is self-evident that the tire of the three-inch wheel will be reduced in thickness much faster by wear than the tire of the five-inch wheel, at least in the proportion of five to three, therefore we may consider the thickness of the tire of the five-inch wheel as only two-thirds of that of the three-inch wheel, and consequently both the tires of the five-inch wheels will weigh 199lbs. being only twenty pounds heavier than the tires of the three-inch wheels. Now suppose this cart with the five-inch wheels and its load to weigh together two tons, the increased weight

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by having five-inch wheels instead of three-inch wheels, is only twenty pounds, as shewn above, or [illegible] part of the whole weight; and if we admit that a horse in drawing such a load on the roads in general, in their present state, acts against a resistance equal on an average to eighty pounds, the additional draft to the horse, occasioned by having the wheels five inches broad instead of three inches, will only be six ounces; and if two horses be used, the additional draft to each horse will be only three ounces. No one can be so ignorant as to contend that the difference in the draught in moving the load above mentioned on the roads in their present state, and on hard good roads, which must necessarily result from a strict adoption of the principle here recommended, will not exceed six ounces; and if it be added, that a greater load will be allowed with five-inch wheels than with three-inch, nothing certainly can exceed the impolicy of continuing the use of narrow wheels. It may be said that the felloes of the five-inch will be something heavier than those of the three-inch wheel, and that this difference is not taken into the above estimate. This difference, if any, is quite insignificant; for wheelwrights well know, that a five-inch felloe may be made nearly as light, if not altogether so, as a three-inch felloe; however, if ten pounds be allowed for this difference, it will only cause an increase of draught of three ounces, when only one horse is used, and but one ounce and a half to each horse, when two are used. It is almost superfluous to add, that the foregoing reasoning is strictly applicable to the wheels of waggons, excepting, that when only two horses are used the increased draught to each horse will be five ounces, but when four horses are used it will only be two ounces and a half to each,

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the weight of the load being the same, viz. two tons, and taking the height of the hind wheel at five feet; and that of the fore at three feet. If the thickness of the tire of the five-inch wheel be even taken at three-fourths of that of the three-inch, the increase of draught to each horse occasioned thereby will be extremely inconsiderable, only two ounces when two horses are used in a cart, reckoning the weight of the felloes equal. It may not be improper to remark, that the actual *wear* of iron on the five-inch wheel will be rather less than on the three-inch wheel, which obviates any objection on the score of expense. As long as narrow wheels, which are the bane and destruction of the roads, are tolerated, the roads can never be kept even in a middling state of repair without an immense expense; but if they be totally prohibited, as herein proposed, the roads (after they had got into a good state, and which improvement will be facilitated by the sole use of broad wheels) they will be kept in good order at a vastly less expense than what is incurred at present to maintain them even in very indifferent repair; the immense importance therefore of adopting the principle recommended above is self-evident; and it has been demonstrated, that it will be for the real advantage of the proprietors of waggons and carts universally; and this will be the case even with the owner of an *one-ass cart*, as it may be proved, in like manner, that it will be his interest to use a five-inch wheel instead of one of one inch or one inch and a half thick: and, let it be observed, that a stout ass will draw half a ton, which with the *narrow* wheel will do more injury to the roads than a waggon with six-inch wheels, and four tons weight. That all the foregoing observations respecting the breadth of the

wheels

wheels of waggons and carts are strictly applicable to stage-coaches and hired post-chaise, gigs, &c. is self-evident; it will therefore be sufficient just to say on this head, that the increase of draught that would be occasioned by broad wheels to each horse in a stage-coach, being so very insignificant, it will be the interest of the proprietors of these latter to use them instead of narrow wheels.

Since the foregoing observations were made, I have seen some extracts in a magazine *, from the other Reports, which have relieved me from a little difficulty I felt on one part of the subject, *viz.* gentlemen's carriages; for I find the Committee recommend that the wheels of these should be from three to four inches broad. The utmost I durst have ventured to propose would have been, that the fore wheels should be five inches broad, and the hind wheels three inches and a half. Whatever breadth may be fixed upon for the hind wheel, the fore wheel ought to be considerably broader, on account of its being of so much less diameter. Now if it be considered how perfectly insignificant the difference of the draught is between wheels recommended by the Committee in this case and those I might have presumed to propose, and that an approximation to the breadths of the latter must evidently be for the benefit of the proprietors of these carriages, as well as of the public at large, gentlemen, perhaps, will not think that they are purchasing this advantage at too high a rate, by diminishing in some measure the elegance (if so it be) of the rims of their carriage wheels.

Permit me to make an observation or two on the most economical method of using the powers of the draught

* See former Numbers of this Work.

horse.

horse. Where a person has constant employ for two horses, I am of opinion it is most advantageous to yoke them both in one cart, for general purposes, not only in level countries, but even in hilly districts, for the following reasons:

I. A single cart may be made one ninth at least lighter than two smaller carts, to carry an equal weight to what they both carry; for the bottom, sides, and ends of the smaller cart ought to be nearly as thick as those of the larger cart, consequently the weight of these parts will be nearly as their areas; but these in the large cart will not be double to those of the smaller, nor will the shafts of the former be double the weight of those of the latter. The wheels of the one and the other, it is self-evident, ought not to be of equal height, but the wheel of the large cart may be made considerably less than double the weight of that of the smaller, yet carry double the load with equal security; and the same may be said with respect to the axletree. For all these reasons, the difference in the weight between the large and the two small carts will be equal at least to one-ninth of the two latter, as mentioned above.

II. The first cost of the larger cart will be less than that of the two smaller ones, and the wear and tear will also be rather less. The harness also of the horses in the larger cart will cost less than that of those in the two small carts.

III. In this neighbourhood a carter has 18*s.* *per* week which makes this sum *per* week difference for driving; and if a man drives his own cart his time is certainly as valuable as a common carter's. It should be considered, that a carter has more to do than drive; he has to load, unload, &c.

IV. I apprehend two horses, whether yoked double or following each other in one cart, will draw with equal, if not more ease to themselves, the same weight, as if yoked in single-horse carts. Does not experience confirm this opinion? for is it not found, that the horse in the single-horse cart is at least as much fatigued or distressed as the shaft-horse in the two-horse cart, and more so than the leading horse in the latter? The reason of this is evident: the exertions of the single horse are *incessant*, without the least intermission, for he is constantly upon the pull; whereas with two horses they alternately relieve each other, by sometimes the one and sometimes the other drawing considerably more than one half of the whole. This relief of each other, though attended with an alternate increase of draught, does not exhaust the animal quite so much as an incessant and unvarying degree of exertion. Suppose a man, for instance, to carry on his back a sack of corn of his own weight, say twelve stone, on a level floor, and walk very slowly for two minutes; and another man, of an equal weight, to stand the same time on *one* leg; the latter will be more distressed than the former, though his leg has only borne the same weight as each leg of the other has on an average borne during the same time, and though each leg of the latter has borne alternately *twice* the weight.

V. The chain horse greatly assists and supports the shaft-horse when he slips or stumbles in frost or slippery roads, and frequently on such occasions prevents his falling, and enables him to recover with more ease from a slip or false step, which is a considerable advantage to the shaft horse.

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VI. In like manner both horses yoked a-breast in hilly districts assist each other alternately when one of them slips or stumbles; and for this reason it would, even in hilly countries, be more advantageous to yoke two horses double in this manner than each in a separate cart.

VII. I apprehend that a cart, of sufficient strength to carry as great a load as a strong horse can draw, with iron arms to the axle, and the wheels five feet three inches high, (and they ought to be that height at least in the present state of the roads in general,) will weigh 10 cwt. and of course two such carts a ton; and supposing the weight of the large cart and its load to be the same as both the small carts and their loads, but the large cart itself one-ninth less in weight than both, as stated above, the difference of the weight of the goods carried will be 249 lbs. Now suppose these three carts employed as common carriers, the large cart with two horses will carry 240lbs. of goods more than the two small carts, which at one farthing *per* lb. for a day's carriage is 5*s.* or 30*s.* *per* week, which, added to the wages of one driver, makes 48*s.* *per* week in favour of two horses yoked in one cart, instead of being in single-horse carts.

TO BE CONCLUDED IN OUR NEXT.

Method

f preparing Ox-Gall in a concentrated State for *s, and for other Uses. By Mr.* RICHARD CA- *of Mead's-row, Westminster-road, near the* *i, Lambeth.*

TRANSACTIONS of the SOCIETY for the Encou- nt of ARTS, MANUFACTURES, and COMMERCE.

eas were voted to Mr. CATHERY *for his Discovery of this Preparation.*

been long a desideratum to find out a method ing ox-gall for the use of painters, so as to disagreeable smell which it contracts by keep- iquid state, and at the same time to preserve its perties. I have invented a method of doing it little expense, which will be to those who great saving, as it will prevent it from putri- breeding maggots.

ll prepared in my method will serve an artist a , as it will keep a great number of years. It convenient article for use, as a small cup of it laced in the same box which contains other co- ere it will be always ready. The qualities of rell known to artists in water-colours, particu- hose who colour prints, as many colours will ut gall work free on such paper, on account of at is used in the printing-ink.

tists who make drawings in water-colours also n the water which they mix their colour with, s away that greasiness which arises from moist on paper, and makes the colour to work clear

 and

and bright. My preparation is ready for use in a few minutes; all that is necessary being to dissolve about the size of a pea of it in a table-spoonful of water.

It is also of great use to housekeepers, sailors, and others, to clean woollen cloths from grease, tar, &c. and will be found advantageous for many other purposes.

Process for preparing Ox-Gall in a concentrated State, by Mr. CATHERY.

Take a gall fresh from the ox, and put it in a basin, let it stand all night to settle, then pour it off from the sediment into a clean earthen mug, and set it in a saucepan of boiling water over the fire, taking care that none of the water gets into the mug. Let it boil till it is quite thick, then take it out and spread it on a plate or dish, and set it before the fire to evaporate; and when as dry as you can get it, put it into small pots, and tie papers over their tops to keep the dust from it, and it will be good for years.

Certificates were received from Mr. Gabriel Bayfield, No. 9, Park-place, Walworth; and Mr. William Edwards, No. 9, Poplar-row; both botanical colourers; stating, that they have used the ox-gall prepared by Mr. Cathery, and find it to answer better than gall in a liquid state; that this preparation is free from disagreeable smell, and is much cheaper, as one ox-gall thus prepared will last one person for two years, and be as fresh as if just taken from the ox.

A Certificate was received from Mr. James Stewart, No. 26, St. Martin's-street, Leicester-square, stating, that he lately belonged to His Majesty's ship the Vestal frigate, and that he took out with him, in a voyage to Newfoundland, a large pot of the prepared ox-gall, for the purpose of washing his greasy clothes for two years; that he found it very serviceable, and to keep its virtue as well as the first day.

Report made to the French Institute on M. TARRY'S *Memoir on the Composition of Writing Inks, &c.*

By MM. BERTHOLLET, VAUQUELIN, *and* DEYEUN.

From the ANNALES DE CHIMIE.

THE end proposed by the author of this memoir is: First, to make known the methods employed for causing writing to disappear from paper. Secondly, those which may be used for reviving writings apparently destroyed. Thirdly, the means of improving the common inks; and lastly, his discovery of an ink that resists all chemical agents: an abridged account of these four articles will be sufficient to give an idea of his work.

On the Methods of making Writings to disappear.

The art of causing writing to disappear is very ancient and very easily performed; and indeed, it is well known, that on wetting a written paper with any acid whatever, the writing immediately becomes fainter, and by degrees it entirely disappears; but all acids cannot be used with

Aa 2 equal

equal success, for some will leave a soil upon the paper that it is difficult to remove, and others corrode it so as to render it completely useless. These inconveniencies may be avoided by the choice of an acid that will only affect the writing without damaging or giving any blemish to the paper.

In order to discover the best acids for this purpose, M. Tarry determined to submit some common ink to the action of different acids, and to observe carefully the effects they occasioned when mixed with it. According to him, the sulphuric acid easily effaces the writing, but at the same time gives to the paper an oily stain.

The oxalate acid of potash produces more speedy and certain effects. The oxygenated muriatic acid, provided it be newly made, appears preferable to the two former, because it bleaches the paper without injuring its quality, at the same time that it effaces the writing. This is not the case with the nitric acid, which, although it effaces the ink, penetrates into the paper, and forms yellow waved lines upon it; these effects however may be weakened by diluting the acid with a sufficient quantity of water, or by washing the paper as soon as the writing has disappeared. A mixture of nitric and muriatic acid has but a slight effect on writing, it bleaches the paper and does not oppose its drying, which is the case when the nitric acid is employed alone. In general, whatever acid is employed, it is best always, when the operation is completed, to immerse the paper in water, in order to dissolve the new combinations which the acids form with the parts of the ink they efface. At the conclusion of this article, M. Tarry observes, that the India-ink is not affected by acids like the common inks,

as

of its composition is entirely different. The acids are so far from attacking it, that they rather make it of a deeper black, and can only be effaced by scraping.

On the Methods of discovering Writings substituted for those that have been effaced, and of reviving such as have been rendered invisible.

All the methods that have been given, for causing writing to disappear, consist, as we have said above, in decomposing the ink and forcing its constituent parts to form other combinations, and these combinations by being decomposed in their turn, will acquire a tint which although not the colour of ink, may be made strong enough to shew the letters and words that have been traced on the paper before it was touched by the acid. The gallic acid and liquid prussiate of lime are tolerably successful for this purpose, and even some hydrogenated alkaline sulphurets. But these never succeed when the acid has been left for a long time in contact with the writing, and especially when the paper has been subsequently washed with water. Indeed it may be easily imagined that in this case, the constituent parts of the ink that have combined with the acid, and have formed compositions with it that are soluble in water, and which this fluid has taken away, cannot have left any traces of their existence, and consequently it is impossible that any chemical agents can restore them. It is also owing to this cause that gallic acid, liquid prussiate of lime, alkaline hydrogenated sulphurets, and so many other boasted re-agents, cannot be considered as infallible for restoring writings.

The

The third article on improving the common inks, merely describes the different sorts that are used, observes that their difference proceeds from the nature of the substances employed in making them, and mentions Mr. Lewis's * ink as the best; but as this ink as well as all others may be dissolved by acids, the author thought it necessary to endeavour to discover an ink that should not be subject to this inconvenience, and announces the success of his researches, of which he speaks in the following terms: "The ink that I have composed is founded on principles different from those of the common inks. It contains neither gall-nuts, Brazil-wood, Campechy gum, nor any preparation of iron; it is purely vegetable; it resists the most powerful acids and indeed any solvent whatever." The Reporters state that they have tried this ink, and have found it to be exactly what M. Tarry describes, but as he does not think proper to publish the receipt for it, they do not relate the experiments made with the intention of discovering the substances of which it is composed.

* See Repertory, First Series, vol. IX.

On

On the Means of retaining the Muriatic Acid disengaged during the Decomposition of Sea-salt by Sulphuric Acid in the large Way, and a Description of an Apparatus for this Purpose. By M. PELLATAN, *jun.*

From the ANNALES DE CHIMIE.

With a Plate.

THE chemists to whom we owe the processes now practised, for obtaining by the decomposition of sea-salt, a soda similar to that of Spain, have not considered the mischief of dispersing in the air a large quantity of muriatic acid; indeed the small scale on which they acted, and the sudden interruption of their labours occasioned by the events of the revolution, prevented them from perceiving the dangerous consequences attending this circumstance.

Since a new impulse has been given to this useful and important branch of industry, we have seen establishments formed in which the enormous mass of salt daily decomposed diffuses in the atmosphere this acid vapour, which being heavier than the air, falls on the surface of the soil and destroys to a great distance all vegetables of any delicacy. Such of these establishments as were at first erected in the neighbourhood of houses, have been obliged to be removed to greater distances, and even this precaution has soon been found insufficient. When in concert with M. Holkere, junior, I was about establishing a manufactory of soda at Rouen, in a place surrounded by houses and gardens, I was sensible from the beginning that we could not suffer to escape

escape with impunity 2400lb. of muriatic acid, which would be produced from the decomposition of 6000lb. of sea-salt daily, in order to manufacture 10,000lb. of soda, for which we had a regular sale.

I contrived various apparatus' for condensing the muriatic acid gas, and it was not until after a great number of trials and a deliberate examination of the circumstances of the operation, that I discovered the method which is the subject of this essay. The general and natural sentiment among those who are occupied in the chemical arts is, to preserve for themselves the advantages that any essential improvement in their processes may give them over their competitors; but in the present instance the general interest becomes the interest of each. Indeed such great inconveniencies have resulted from the existence of soda manufactories in the neighbourhood of inhabited places, that the legislature has found it necessary to order their removal to the uncultivated lands.

The first idea that occurs to those who wish to retain the muriatic acid, in a decomposition in the large way, is to employ water, for which the great affinity of this gas is well known, and under this impression I made a variety of experiments from which I was at length forced to conclude; *that water is not the means of retaining completely the muriatic acid disengaged by the decomposition of salt in stoves in the large way.*

To saturate the muriatic acid with a body, to the contact of which it should be exposed in its passage from the muriate of soda, was the next method that occurred to me, and carbonate of lime being the most common substance capable of answering this purpose, I made

made choice of it for my experiment, and it afforded the following advantages.

1st. It does not let any part of the muriatic acid escape. 2dly. The muriate of lime that is formed is greedy of water, exhausts the vapour, and prevents that mist which is always so inconvenient even when it is not acid, and which forms the vapour when it quits the chimney. 3dly. It saves the labour that is required to raise the water for the condensation of this acid, and allows of the erection of manufactories in situations that are deprived of water. 4thly. Its action is certain, and cannot suffer from the negligence of workmen. 5thly. The muriate of lime that is formed, affords a method of collecting and preserving in a small compass all the muriatic acid that has hitherto been lost to the manufacturers of soda; and it is particularly in this state that the muriate of lime is most useful in the arts and to society.

I believe a model is the surest way of describing the method of applying this agent to apparatus that are made for decomposing muriate of soda in the large way, and I shall add a short description to it.

The whole apparatus may be divided into three parts: the stove, the pipe in which the carbonate of lime is deposited, and the chimney. The floor of the stove is laid with bricks, and the top is arched lengthwise only; at one of its extremities is the fire-place with a grate and ash-hole, which occupies the whole width, and may have two doors. The fire-place is separated from the floor by a wall eight inches in height and one foot in thickness; further on is a similar wall which divides the stove into two unequal parts; the first and smallest serves

for the calcination, and has two doors; the other is furnished with a leaden vessel, in which the first action of the acid on the salt takes place.

The sides of the stove as far as the fire-place, and that which serves for the calcination, are closed up with brick walls; the part that contains the leaden vessel is not closed up on the sides, as the vessel itself is made to rise for that purpose above the arch. In one of the sides an opening is made which is closed with a plate that fits it, and by which the salt is introduced; above it there is a smaller hole through which the oil is poured, and by which it is stirred. On the opposite side there is but one small opening, which is for the purpose of stirring it.

The whole is bound together by proper iron-work, which serves at the same time to sustain the lead. At the extremity opposite to the fire-place there is a descending chimney which leads to a double channel, and is furnished with cast-iron dampers or doors.

The canal is divided by a partition wall and sustained by two lateral walls, so as to leave two spaces of three feet each in depth and width, and 60 feet in length, and every three feet alternately there is a small wall 18 inches high, and an arch that leaves below it a space of the same heighth; the whole is covered by a double row of planks, that are coated with lead on the lower surface; these two passages terminate in the same chimney by two openings furnished with grooves and trap doors.

The chimney, which is 30 feet high, is constructed in an arch at the extremity of the double conduit, to serve occasionally to one and the other: in its interior and as low

low as possible, a small fire-place is made, which has an ash-hole, closed by a door which is opened when necessary, in order to feed with air a coal fire that is used to produce a draught.

If the stove is twelve feet by six wide, and the leaden vessel eight feet by six, it will be capable of decomposing at one time 1500 pounds of salt.

In order to set this apparatus to work, the fire of the chimney is lighted, the canal filled with lumps of carbonated lime of middling sizes. The planks are laid on one of the canals and covered over with clay, or only with a bed of earth, and lastly the valve, at each extremity of the canal that is to be used, is opened. This being done, the salt intended for decomposition is thrown into the leaden vessel by the large opening; the piece that closes it is fixed on with clay, and the acid is poured in by the small opening that is above: it is stirred with an iron rod, so contrived as not to bruise the leaden vessel, which must not be more than a line and a quarter in thickness. The fire must be moderately kept up, and the whole operation is terminated in 24 hours at the most.

The operation may be said to be finished, when on withdrawing the rod it ceases to smoke immediately, and if the matter congeals quickly in the air, then all that the leaden vessel contains must be let out upon the earth or into another vessel, by opening the great door of the pan, and it is necessary that the stove should be kept open and the fire discontinued for an hour before this is done, as the matter is then less heated, congeals quicker, and gives less vapour.

The matter thus hardened by cooling is calcined during the following operation in the first division of the stove;

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stove: as it becomes liquid again for a moment by the sudden effect of the fire, it is proper each time to fill up the entrance of the calcining stove with bricks; it must also be often stirred, which is easily performed by the doors that are made in this part of the stove.

The ash-hole doors can be closed at will, or regulated according to the wants of the fire; but their openings should always be very small, that it may permit of the opening of the other doors without losing the steam.

During this operation not any visible acid vapour escapes by the chimney, and the masses of carbonate of lime are briskly attacked; and as the vapour occupies the upper part of the canal which becomes open to admit it, from the immediate sinking of the stones that fill this conduit, it would thus soon escape and effect the contact which it is so important to be assured has taken place. It was to avoid this inconvenience that I constructed the small walls and arches alternately along the conduit, which force the gas to fall down again towards the bottom, and then to re-mount, after having passed through the mass of calcareous stones, which is necessary to perfect the effect.

When only one of the conduits is employed its traps should be set open in order to admit the vapour, and those of the other must be kept closed; then that which is unemployed must be uncovered, cleaned, and filled afresh, against it is wanted. All the bricks used in this construction should be very hard baked, and made of poor sandy clay. If it be desired to collect the muriate of lime that is formed, the bottom of the two channels may be coated with clay, so disposed as to form a gutter inclined a little towards a deeper cavity into which the deliquiscent

deliquescent salt may be easily conducted, and its solution being greatly concentrated allows of its being stored in casks or a cistern.

Independently of the certainty of retaining the whole of the muriatic acid and the advantage of preserving it, the structure that I have described produces a great saving, in performing with a single fire the two operations of the first decomposition of the salt, and the calcination of the sulphate, which have always till now been done separately. On the other hand, the leaden vessel by being left uncovered, allows the degree of heat to be ascertained by which it may be prevented from melting, an accident that often happens in the ordinary stoves. Finally, this vessel is so disposed, that in an instant it can be withdrawn from the stove, and another substituted for it which is kept in readiness, that there may be no interruption to the work.

The doors can be opened every moment, without letting out any of the acid vapour which is so injurious to the workman, and so dangerous to the neighbourhood.

Occupied entirely until now with my works as a manufacturer, who was obliged to console himself for the obscurity of his existence by the utility of his labours, I shall have fulfilled my purpose if the class give a favourable reception to this new method, and authorize its use by the sanction of its approbation.

Conclusion.

We think that the younger M. Pellatan has rendered an important service to the manufacturers of soda by the improvement he has made in their stoves, by which they are relieved from the fear of damaging the surrounding vegetables

vegetables and from the interference of the police; an
we therefore think that the class should grant its appro
bation. We also think it would be useful if the Auth
were to print his memoir, and make a drawing of th
model, in order that it may be known in all plac
where manufactories of soda are established.

Explanation of Plate X.

Fig. 1. Section and elevation of the stove at the li
K, Fig. 5.

Fig. 2. Section and elevation at the line M N.

Fig. 3. Elevation at the line G H.

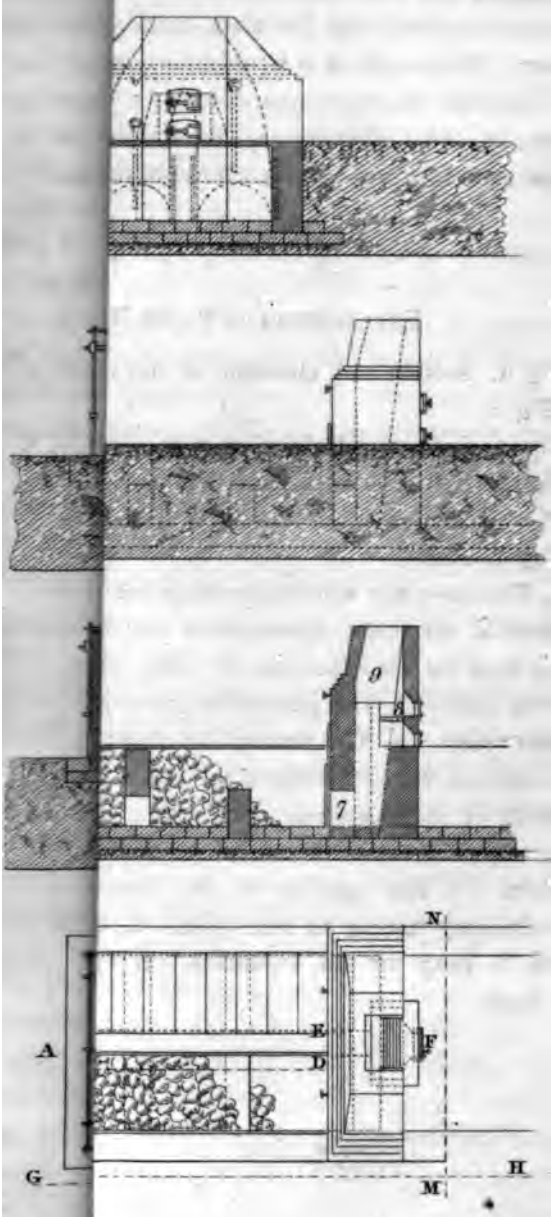
Fig. 4. Section at the line A B, C D, E F.

Fig. 5. Plan.

1. The fire-place with the gratings and doors. 2. Th
division of the stove, appropriated to calcination, sep
rated from the fire-place and the other part of the sto
by two walls. 3. The part of the stove that contains th
leaden vessel. 4. The descending chimney which com
municates at will with either of the two channels. 5. Th
opening of the communication, which is shut with a
iron trap door. 6. The calcareous stones that fill th
channel. 7. The opening of the communication wi
the chimney having an iron door. 8. The small fir
place to keep up the aspiration. 9. The chimney
feet high.

I

[redacted]



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List of Patents for Inventions, &c.

(Continued from Page 128.)

n Dobson, of the town and county of Newcastle-Tyne, Upholsterer; for certain improvements in nufacture of rudder-bands and bolts for shipping. May 1, 1811.

Moore, of Newington Causeway, in the county ey, Lace-net-manufacturer; for a machine or s for the manufacture of gold and silver twist, tton, or thread, twisted lace-net, similar to and ng the Buckinghamshire and Northamptonshire made by the hand with bobbins on pillows; naking iron, brass, or copper wire-net. Dated 811.

Hall, of Hethersett, in the county of Norfolk, ; for an improved cooking stove. Dated May

Cranfield, of Ilminster, in the county of for an improvement upon machines for spinning of cotton, flax, tow, hemp, wool, and twisting of thread. Dated May 7, 1811.

Jones, of Oxendon-street, Piccadilly, in the Middlesex, Mathematical Instrument-maker; nstrument for dividing lines and distances, be useful to mathematicians, architects, and Dated May 9, 1811.

Hawkins, of Water-lane, Tower-street, in London, Ship and Insurance-broker; for an culated for the better defence of ships and erent descriptions against being boarded or ion of by an enemy. Dated May 9, 1811.

William

William Gilpin, of Wedges Mills, near Litchfield, in the county of Stafford, Augur-maker; for an improved method of manufacturing augurs. Dated May 16, 1811.

John Street, of Hillfield-place, Clifton, in the county of Gloucester, Esquire; for improvements in the mode of making and working of bellows. Dated May 21, 1811.

William Jenkins, of Birmingham, in the county of Warwick, brass-founder; for an improvement in the method of manufacturing flat backed handles and rings of different shapes and forms, used with or affixed to cabinet and other furniture and things, whereby much labour and expense in the manufacturing thereof are saved. Dated May 21, 1811.

James Parsons, of Wellington, in the county of Somerset, Builder; for improved hinges and pulleys for doors and windows. Dated May 21, 1811.

John Dickinson, of Ludgate-hill, in the city of London, Stationer; for improvements in machinery for making, cutting, and placing paper. Dated May 21, 1811.

David Brewster, of Edinburgh, North Britain, Doctor of Laws, and William Harris, of Holborn, in the county of Middlesex, Optician; for their optical instruments for measuring angles; and also certain instruments upon and additions to telescopes and other optical instruments for the purpose of measuring angles and distances with facility, and for other purposes. Dated May 21, 1811.

[redacted]

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXII. SECOND SERIES. Sept. 1811.

Specification of the Patent granted to PETER DURAND, *of Hoxton-square, in the County of Middlesex, Merchant; for a Method of preserving Animal Food, Vegetable Food, and other perishable Articles, a long Time from perishing or becoming useless. Communicated to him by a Person residing abroad.*

Dated August 25, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Peter Durand do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: First, I place and inclose the said food or articles in bottles, or other vessels of glass, pottery, tin, or other metals, or fit materials. And I do close the aperture of such containing vessels so as completely to cut off and exclude all communication with the external air; and as to the method of closing, I do avail myself of the usual means of corking, wiring, cutting, or cementing: and in large ves-

[redacted]

sels I make use of corks, formed of pieces glued together in such a manner as that the pores of that substance shall be in a cross direction with regard to the aperture into which such corks are to be driven. And I do also, in such vessels as may admit of or require the same, make use of stoppers, fitted or ground with emery or screw caps, with or without a ring of leather, or other soft substance between the faces of closure, and also of corks or cross plugs or covers of leather, cloth, parchment, bladder, and the like.

Secondly. When the vessels have been thus charged and well closed, I do place them in a boiler, each separately surrounded with straw, or wrapped in coarse cloth, or otherwise defended from striking against each other. And I fill the said boiler so as to cover the vessels with cold water, which I gradually heat to boiling, and continue the ebullition for a certain time, which must depend upon the nature of the substances included in the vessels, and the size of the said vessels, and other obvious circumstances, which will be easily apprehended by the operator without farther instruction.

Vegetable substances are to be put into the vessel in the raw or crude state, and animal substances partly or half cooked, although these may also be put in raw.

The food or other articles thus prepared may be kept for a very long time in a state fit for use, care being taken that the vessel shall not be opened until their said contents shall be wanted for consumption.

And, lastly, I do declare, that although the application of the water-bath, as hereinbefore described, may be the most commodious and convenient, I do likewise avail myself of the application of heat, by placing the said vessels in an oven, or a stove, or a steam-bath, or any

any other fit situation for gradually and uniformly raising the temperature of the same, and suffering them to cool again.

And farther, that I do, as the choice of the consumer, or the nature of the said food or other article may render preferable, leave the aperture of the vessel, or a small portion thereof, open, until the effect of the heat shall have taken place, at which period I close the same.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

When I received from a friend abroad, more than a year ago, a communication of the discovery above described, I perceived that there was still a great deal to be done to render it perfect, and to produce a fit substitute on board ship for salted meat and other provisions, which are usually preserved by means of spirits or acids. In consequence I employed myself in making experiments upon a much larger scale than had hitherto been done. I substituted tin cases instead of glass jars or bottles, and prepared to the extent of thirty pounds of meat at once. Being convinced that the operation was as sure in large quantities as in small, I wished, before offering my services to my countrymen, to have the approbation of those who might inspire them with confidence. I therefore requested Sir Joseph Banks to do me the favour to receive some cases of meat, of different sizes, as well as of milk and soup. These several boxes he had the goodness to have opened in his presence, and the contents were found perfectly preserved, though several months had elapsed. A number of scientific gentlemen, both of the Royal Society and of the Royal In-

 stitution,

stitution, having at his request examined and analyzed the different provisions, found them perfectly preserved.

Two cases that had been preserved during six months, and for four months on-board of one of His Majesty's ships, were brought on-shore: one of them was opened, and every thing found as fresh as if packed but the day before. The other case is reserved to be opened some months hence.

In fine, all the experiments are so decisive, that I presume that no one who goes to sea, whether in the navy or merchant service, will hesitate to adopt the process, which will contribute to their health, and procure them in long voyages every kind of provision as fresh as on shore, and with a trifling expense.

Specification of the Patent granted to DAVID LOESCHMAN, *of Newman-street, in the Parish of St. Mary-le-bone, in the County of Middlesex, Piano-forte-maker; for Improvements in the musical Scales of keyed Instruments with fixed Tones, such as Pianos, Organs, &c.*

Dated July 26, 1809.

With Engravings.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said David Loeschman do hereby declare that my said invention is described in and by the drawings and description thereof hereunto annexed, and in manner following; that is to say: The scale of a piano-forte, or organ on the common principle, having twelve sounds within the octave, I have by my invention extended to twenty-four distinct sounds, which enables the performer

to

to play in thirty-three perfect keys, eighteen major (thirds), and fifteen minor thirds: and this I have effected by means of six pedals, that cause the hammers to act upon twenty-four distinct sets of strings or unisons. Three pedals bring on the flats to the treble; and the like number bring on the sharps to the bass. By reversing my mechanism I produce also the same effect; in which case, by three of the pedals the flats are brought on to the bass, and by the other three the sharps are brought on to the treble. Every pedal has a separate movement and spring, which act independent of the key: on each movement are fastened two of the twelve hammers belonging to each octave throughout the compass; so that a pedal for the flats brings on two additional flats in each octave, and in like manner a pedal for the sharps brings on in each octave two additional sharps: when such additional flats or sharps are no longer wanted, by omitting the use of the pedal the spring belonging to it immediately leaves the movement to its former position or fixed tones, of three sharps, two flats, and seven natural notes in each octave. The mechanism for the flats and sharps is so constructed, that if more sharps or flats are wanted than one pedal will produce, a second, without the first, will be sufficient to bring on two of each in addition. So also, if more sharps or flats than the second pedal will produce are wanted, the third, without the first or second, is sufficient to bring on two of each in like manner. Each pedal is made to fasten, if it should be wanted.

In organs, the improvement is effected also by six pedals; and in each octave there are twenty-four distinct sounds, from twenty-four distinct pipes: there is a separate movement and spring to every pedal. Every fixed key

key has two stickers, two black-falls, and two pallets, which act on two pipes of different sounds. Three of the six movements are fixed in the middle of the front, above the keys, and bring on the sharps to the back of the organ, and the same number are fixed in the like direction behind, to bring on the flats towards the front. By fixing all the six movements in the middle of the front above the keys, or in the same situation behind, I produce also the effect desired. By reversing the movements, my mechanism will admit of bringing on the sharps and flats, either to the front or back of the organ; or, if wanted, my mechanism will admit having both the sharps and flats, either before or behind the instrument. With regard to the pedals and their construction, action, &c. I refer to that part, before described, relative to such, in my piano-forte specification.

In witness whereof, &c.

REFERENCE to the ENGRAVINGS.

In the profile or longitudinal section of this instrument, (Plate XI. Fig. 1,) the following parts are the same as the instruments now in use. A, the finger-keys. B, the raised black keys for flats or sharps. C, centre-piece of the keys, and D centre pins. E, the key-frame. F, the bottom of the instrument. G, the name-board. H, the rest-pin block, and *h* the pins for the strings. *i*, the lever attached to the keys for throwing up the hammers. *k*, the sockets for guiding the levers. *l*, is the receiver for the hammers attached to the keys. *m*, the dampers, and *n n* its sockets fixed to the block *o*, which supports the sounding-board *p*. *q* is the bridge for the strings.

The

The upper movements marked 1, 2, 3, are fastened with screws and small brass plates upon the standard block 4. These, by the three left-foot pedals, bring on the flats from the bass to the treble.

The three under movements, marked *a*, *b*, *c*, are fastened with screws, as the upper movements. The first of these three movements, *a*, is let into a groove in the standard block 4, under the upper movements.

The second movement, *b*, is under the standard block.

The third movement, *c*, is fastened on the bevel of the standard block. These bring on the sharps, by the three right-foot pedals, from the treble to the bass. These movements or pedals may be reversed, and the same purpose will be answered.

The regulating screw 5, in the regulating board 6, is for regulating the hammers 8. 9 is a small double square of iron, one end of it is screwed to the standard block 4; the other end is screwed to the regulating board 6, to keep it steady: each hammer has a separate centre-pin fastened in a piece of brass marked 10. Two of these pieces of brass with the hammers are screwed to each of the six movements (1, 2, 3, and *a*, *b*, *c*,) within the octave.

The keys are independent of the hammers, and the action. In the two profiles, Fig. 2, which are taken on a plane parallel to Fig. 1, but at the opposite ends of the movement, *s s s* are the springs acting on the ends of the respective movements 1, 2, 3, and *a*, *b*, *c*, the springs are fastened to the action stool 4, *p p* are the pedal irons for the same. These are fastened under the bottom of the instrument, and go through the bottom of the right and left side of the action-stool, as is described in the profiles;

profiles; when, therefore, a right or left foot pedal presses the movement, a spring at the other end, belonging to the movement, will (when the pedal is left off) bring the movement in an instant to its former place.

Fig. 3 is a plan looking down upon the movements when there are six of them, or six pedals; 1, 2, 3, are the movements, the same as in the former figures, 8 the hammers, and 10 the pieces of brass supporting them, and fixed with the movements, the letters in the row 14 (which are supposed to be marked on the hammers) are the twelve standing or fixed notes, as in our common compass within the octave, *viz.* three sharps, two flats, and seven naturals. The letters in the upper row 15 are the twelve additional notes which I have introduced, the six sharps are obtained by the three right-foot pedals, the six upper flats are obtained by the three left-foot pedals. We have, therefore, twenty-four notes in the octave with our common scale.

Each of the three right-foot pedals for the sharps bring on, in addition, two sharps in the octave from the treble to the bass, as follows:

The first right-foot pedal brings on	D*	A*	When drawn towards the bass end.
by the piece of brass marked in Fig. 3	10^{1st}	10^{1st}	
The second ....do..........do..........	E*	B*	
By the brass..............	10^{2d}	10^{2d}	
The third ....do.........do.........	F**	C**	
By the brass..............	10^{3d}	10^{3d}	

In like manner each of the three left-foot pedals for the flats brings on in addition two flats, in the octave, from the bass to the treble.

The

The first left-foot pedal	A^b D^b	When drawn towards the treble end.
The second	G^b C^b	
The third	F^b B^{bb}	

In Fig. 4 the range of letters marked 14 are the twelve standing or fixed notes as in our common compass within the octave, *viz.* three sharps, two flats, and seven naturals; of the eight upper additional notes, the four sharps are obtained by two right-foot pedals, and the four flats are obtained by two left-foot pedals: we have, therefore, only twenty notes in the octave with our common scale, and they are obtained in the same manner as before described of Fig. 3, with six pedals. But four of the standing or fixed notes, *viz.* G A D E, remaining unmoveable, being fastened to the standard block 4, as is shewn also in Fig. 1, whereby we cannot obtain F✱✱, C✱✱, Fb, Bbb, we may reverse the movements or the pedals to bring on the flats from the treble to the bass, and the sharps from the bass to the treble, by which contrivance we gain the same end.

In Fig. 3, with six pedals marked 1, 2, and 3 movements; and in Fig. 4, with four pedals marked 1, 2 movements, will be easily and clearly shewn how two notes in each octave are fastened to each movement, and how the movements slide in brass plates under screw heads when used by the pedals.

Description of the Drawings of the Harmonic Organ.

Fig. 5 (Plate XI.) is a profile of the keys and movements, shewing the new improvements; but the parts common to all organs being first pointed out will render

what follows more explicit: these are, A the finger-ke B the key-frame, 8 8 the stickers, which are double number of those in the organs now in use, and D th sockets; E the backfalls for opening the valves of th respective pipes.

The front movements 1, 2, 3, above each other, about three-fourths of an inch above the keys, and th are fastened upon the standard block 4, in the sa manner as described in the piano; but the sloped e of the three movements marked 5, rest behind upon keys behind, and they are hinged to the front part the three movements. The block 6, underneath stickers 8, works in the centre pin 7; it is fastened l neath the under socket D, and it rests upon the up end of the movement 5, the lower end of the sticke rests upon the centre block 6. The backfalls are f tened to the upper end of the sticker 8; therefore, wh a key is pressed down in front, the keys behind lift the part of the movement 5, with the centre block and the sticker 8, with the backfall, which opens t pallet to give the desired note; but when more sha are wanted, by pressing the right-foot pedal the fr movement, with the hinged part of the movement 5, w shift itself to the back end of the centre block 6, wh will give the note that is wanted in the same manner before, only that the front note is now silent.

The manner of this is shewn in the plan Fig. 6, wh 1 is the movement, and *k* a bar to which the moveme 5 are hinged: when 1 is moved endways by a pedal u der its screw-heads, it throws *k* away from it, under screw-heads *l*, by means of the brass rods *m m*. Th motion shifts the movement 5, Fig. 5, from beneath o end of the centre block 6 to the other.

T

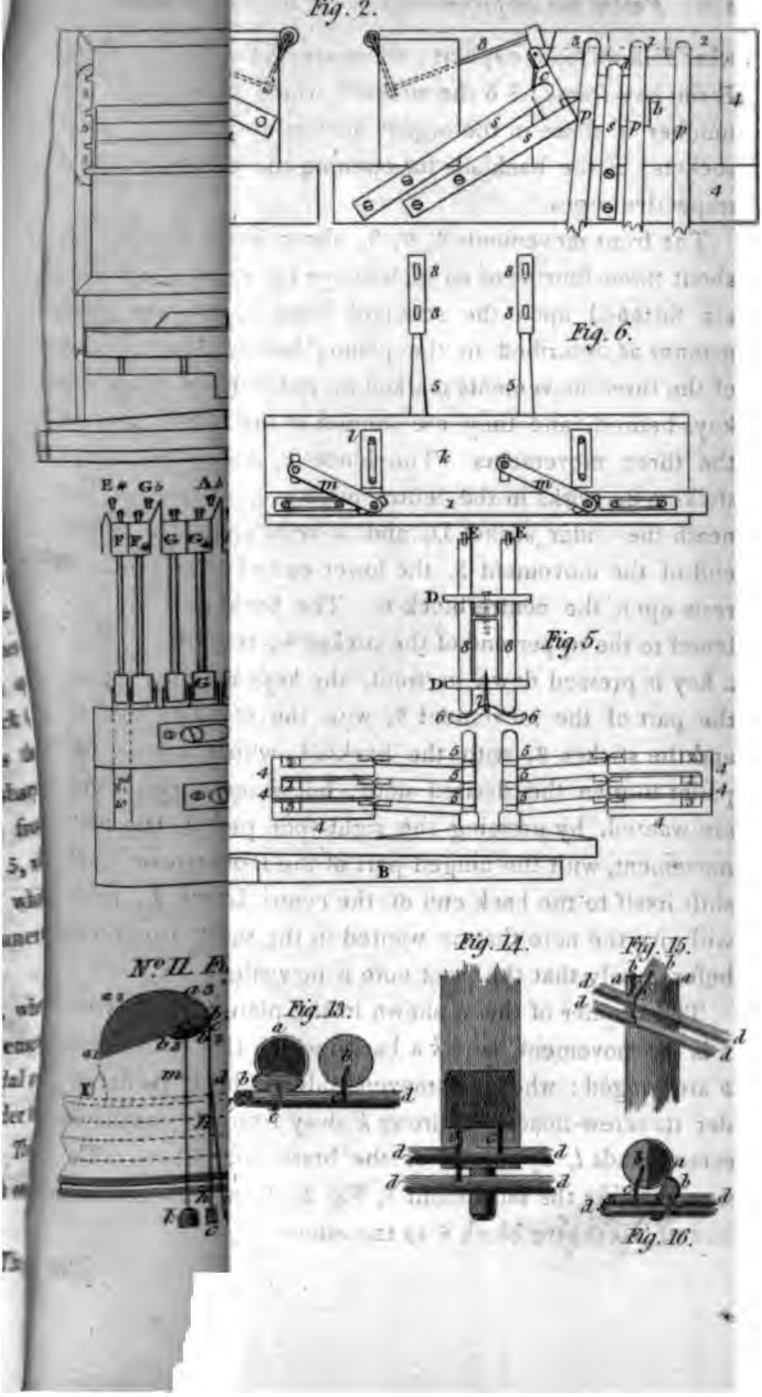


Fig. 2.
Fig. 6.
Fig. 5.
Fig. 13.
Fig. 14.
Fig. 15.
Fig. 16.
No. II.
E# Gb Ab

The back movements act towards the front in the very same manner as the front movements, which have been described.

Instead of the centre block No. 6, it may be made with springs, placed in different ways, on a strong under block, as is shewn in the elevation at X, Fig. 7, and in the plan Fig. 8. The six movements may be placed together in front, above the keys, or behind the keys, the flats and sharps may also be produced in the same manner as in the pianos, the effects will be the same.

The springs and pedals to the organ act in the same manner as in the pianos. The pedals for the organ as well as for the piano may be fastened, if those notes made by pedals are wanted to be used for a length of time in playing, in the same manner as on harps. The mechanism in the organ and piano, for the flats as well as for the sharps, is so constructed that the pedal 3 must likewise bring on the notes belonging to pedal No. 2 and 1; and the pedal 2 must also bring on the notes belonging to pedal 1. This effect may also be obtained by the tread of the pedals.

Note.—In the specification, another large drawing of the harmonic organ is given. It describes a second method of performing the same movement, as above described: the chief difference is, that the stickers 8 8 are all arranged side by side in one row instead of two; but as this method crowds the organ up very much, it has never been put in practice by the Patentee: on this account, and that it would exceed the limits of our plate, we have omitted this second drawing; it contains nothing material which is not shewn by the figures we have given.

Specification of the Patent granted to HENRY LISTON, *of Ecclesmacham, in the County of Linlithgow, Clerk, and* CHARLES BROUGHTON, *of the City of Edinburgh, Writer to the Signet; for Improvements in the Construction of Organs.* Dated July 3, 1810.

With Engravings.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said Henry Liston and Charles Broughton do hereby declare, that our invention consists, First, in causing each organ-pipe to afford several tones differing from each other in acuteness or gravity, by applying to the mouth of a pipe, or to the open end of an open pipe, one or more moveable shades, which are performed by means of a pedal or pedals, or by a stop or stops for the hand, or in any other way, may be enabled to remove from, or bring to, the mouth or open end of the pipe at his pleasure. These shades are made of thin plates of lead or pipe-metal, such as is used in the manufacture of metal pipes, (thicker or thinner, according to the size of the shade,) or of other convenient materials. The shades bear a different proportion to the mouths or open ends of the pipes to which they belong, according to the degree of alteration intended to be produced on the pitch of the pipes. When it is intended to alter the pitch of a pipe, by what is called the enharmonic fourth of a tone or the diesis in a tempered system, then the shade is of such size as to cover the whole length of the mouth (across the pipe) rising about as much above the upper-lip, or of such size as to cover the whole open end of the pipe, and one such shade the

only is applied to each pipe; or the pitch of an open pipe may be altered, the diesis, by means of one shade at the mouth to alter it in part, and another shade at the open end to alter the pitch as much more as requisite. This is chiefly useful when, as sometimes happens, the pipe cannot well bear to be altered the whole diesis at the mouth or open end, or in the case of open wooden pipes, which are tuned by means of a fixed shade at the open end. When it is intended that each shade should alter the pitch by what is called comma, being the difference between the major and minor tones in a system of perfect intonation, then there may be two shades to the mouth or open end of each pipe, and the one shade is made to cover a little more than the half of the mouth across the pipe, but rising as much as the formerly-described shade above the upper lip, or a little more than the half of the open end of the pipe; and the second shade is made to cover the remainder of the mouth or open end: or, in the case of an open pipe, one shade may be applied to the mouth to alter its pitch comma, and another shade may be applied to the open end to alter it another comma. For the convenience of being removed from or brought to the pipe, the shades are fixed on rollers or cylinders of wood, or other proper materials moving on pivots. For the purpose of attaching the shades to the rollers, each shade may be soldered to a piece of tinned wire, or brass wire; which piece of wire may be screwed into the roller, or the shade may be attached to the roller in any other convenient way. When two shades are applied to the mouth or open end of one pipe, or when in a range of pipes the shades of some are upon different rollers from those of others, then the rollers may be arranged one

those

above another; the wire or stalk by which the shade is attached on the lower roller bending round the other roller or rollers, so as to apply the shade close enough to the mouth or open end of the pipe to which it belongs; or, when convenient, one or more rollers may be placed on one side, and the others on the other side of a range of pipes.

Description of the Engravings of the Enharmonic Organ.

No. 1, Fig. 9, (Plate XI.) shews two pipes shaded at the mouth, each with the single shade, to alter the pitch by diesis. *a a a a*, the mouths of the pipes. *b b b b*, the shades represented transparent, that the mouths may be seen. *c c*, the wire or sticks by which the shades are attached to the rollers *d d*, the stalk attached to the lower roller, bending round the roller above it. *e e*, supports for the pivots of the rollers, one at each end of the range of pipes.

Figs. 10 and 11 are side views of a pipe shaded at the mouth, to shew the positions of the shades when close applied and when removed, the reference being the same as in Fig. 9.

Fig. 12 shews two pipes shaded at the open end. *a a a a*, the open ends. *b b*, the shades. *c c*, the stalks which attach the shades to the rollers *d d*, which are represented sloping, to correspond with the tops of the pipes. The shade attached to the upper roller is represented as close applied to the open end of the pipe, and that on the lower roller is removed from the pipe to which it belongs.

Fig. 13 is a bird's-eye view of the same.

Fig. 14 is a pipe, having two shades at the mouth, each to alter the pitch a comma.

Fig.

[redacted]

Fig. 15 is a pipe with two shades at the top or open end, the one being close applied and the other removed.

Fig. 16 is a bird's-eye view of the same. The references in these figures will be understood from what has been already said. The use of these moveable shades is, that by means of them organs can be constructed with more complete scales than those in ordinary use, without so great a multiplication of pipes as without this invention would be necessary.

And whereas, from the ordinary construction of the bellows, those at least which rise on four ribs of equal breadth at each side and each end, they do not blow with an uniform force, but with less force when full, and with a continually increasing force as the top sinks, and *vice versâ*; we, the said Henry Liston and Charles Broughton, declare, that our invention consists, secondly, in a regulator, which renders the blast of the bellows perfectly equable. This regulator is shewn by No. II. Fig. 9: it consists of a spiral piece of wood, or other proper material, *a*, 1, 2, 3, of about half an inch in thickness, more or less, according to the size of the machine, and of a pulley *b*, 1, 2, 3, of similar thickness, fastened to the spiral. This machine turns on a pin at the common centre of the spiral and pulley *c*. The string *d d d* is fastened to the pulley *b*, 1, 2, 3, at *c*, and being wound round it, passes under a small pulley at *f*, and is fastened to the top-board of the bellows at *g*, at about an equal distance from either end. Another string *h h*, fastened to the string *d d d*, passes under a pulley at *i*, goes under the bellows, and a similar pulley on the other side, and is fastened to the opposite side of the top-board; that when these strings act on it, they may pull

pull both sides equally. These three small pulleys may run in one piece of wood, as shewn in Fig. 17, which, being placed under the bellows, may be fastened to the frame of the organ: the weight or counterpoise *l* is suspended by a string *m*, at the centre of the spiral, when the bellows are quite empty. When, therefore, the bellows begin to rise, the strings *d d d h h* are drawn so as to turn the pulley, and consequently the spiral in the direction *b*, 1, 2, 3, and then the string *m* is taken upon the edge of the spiral, which is grooved to receive it; thus, as the bellows are gradually losing force, the counterpoise *l* is gradually gaining power, by the increasing radius of the spiral on which it acts. If the bellows rise so much as to cause the pulley and spiral to make an entire revolution, the weight *l* will be in the position *k*, acting on the extremity of the spiral; and as the bellows sink, the spiral, turning in the opposite direction, will gradually unwind the string, so that the counterpoise will act on a radius continually decreasing as the force of the bellows is increasing. The accuracy with which the regulator will equalise the force of the blast, depends on three circumstances; the form of the spiral, the size of the pulley *b*, 1, 2, 3, and the weight of the counterpoise *l*; the spiral curve is to be formed by the following rule: Describe a circle of any convenient diameter, and supposing the whole circumference to represent the size of the greatest angle which the ribs of the bellows make with the bottom or top boards. Assume any point, and from thence divide the circumference into segments (always measured from the same point) respectively proportional to the sines of the angles up to that greatest angle. It will be sufficiently accurate to take the sines of the first five degrees, thence the

the sines of each half degree up to 15°, and thence to the greatest angle (the entire revolution) each quarter degree, draw radii to all these points. Then from the centre of the circle measure off each radius proportionally to the secant of its respective angle; and from this point draw a perpendicular to the radius; these perpendiculars, by their mutual intersections, will form an irregular polygon, approaching to the curve required. The scale of equal parts, by which the radii are measured proportionally off, to the secant of the angles, will be greater or smaller, according to the size of the bellows to be regulated. For a chamber organ of four or five stops, the secant of the greatest angle may be about ten inches: for large bellows it may be considerably larger, otherwise the weight or counterpoise might be inconveniently great: the size of the pulley is to be such that its circumference shall be exactly equal to the rise of the bellows when the ribs make the bottom or top boards, the greatest angle for which the spiral is made: the size of the pulley will, therefore, *cæteris paribus*, depend on the breadth of the ribs. Thus, if the breadth of the rib be five inches, the circumference of the pulley should be equal to twice the size of the greatest angle, as put down in the ordinary table of sines, tangents, &c. calling the first figure of the table inches, and the rest decimals of an inch. If the ribs be less or more than five inches, the circumference of the pulley will be found from the tabular sine by a statement in the Rule of Three. First, as five is to the tabular of sine, so is the rib to a fourth proportional; which being doubled, is the circumference required. The weight of the counterpoise will be most easily found by experi-

 ment.

ment. If it be too little, it will correct the evil in part, but not entirely: the bellows will, therefore, still gain some force as they fall. If, again, the counterpoise be too great, the bellows will have most force when full, and will gradually lose force as they fall.

In witness whereof, &c.

Specification of the Patent granted to RICHARD JACKSON, *of the Bear Garden, Bankside, Southwark, in the County of Surrey, Manufacturer; for a Method of making the Shanks of Anchors and other large Bodies of Wrought Iron of a similar Form, by using one solid Core of Iron for the Centre, with Bars of Feather-edged Iron, so made up, constructed, and applied, as to save a considerable Quantity of Iron, Coals, and Labour, in the Manufacturing of the same, and which will naturally add to the Strength and Soundness of all large Bodies of Wrought Iron so manufactured.*

Dated March 7, 1811.

With Engravings.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Richard Jackson do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in the plan drawn in the margin of these presents, and the following explanation thereof; that is to say: A, Fig. 1, (Plate XII.) exhibits a solid taper core of wrought iron, which is to be manufactured of the

the best scrap or faggotted iron to the size wanted, (in the usual way of heavy smiths' work,) until it becomes perfectly solid and sound. The core is then laid into bars of feather-edged iron, previously rolled and prepared for that purpose, as shewn by the plan drawn in the margin marked B, Fig. 2, which exhibits the solid core (half hid) and the sides of two bars of feather-edged iron. The remaining part of the bars are then laid round the core, so as to form the shank or other large body of iron, as shewn by the plan marked C, Fig. 3, and hooped up to keep it together, as also marked with the letters D. And in order to form the shape of the shank, as exhibited by the plan marked with the letter C, Fig. 3, tapered splices of iron must be used and drove down between the bars to a fine splice, as shewn in the plan marked with the letters E. The shank or other large body being thus prepared, is fit for the forge, and is then to be manufactured in the ordinary way of making shanks of anchors and other large bodies of wrought iron, until it becomes one solid and sound body of iron. And by laying up the iron with the solid core, and making the shank or other large body of iron in the form and by the method hereinbefore described, it will not require so many heats as were before necessary in the common mode of manufacturing shanks of anchors, or other large bodies of iron. The body itself will be more sound, and a considerable quantity of iron, coals, time, and labour will also thereby be saved.

The plan of the section in the margin marked with the letter F, Fig. 4, shews the section of the butts or large end of the shank marked in the plan with the letter C. And the plan of the section in the margin marked with the

 letter

letter G, Fig. 5, shews the section of the small end of the round of the shank in the plan marked C.

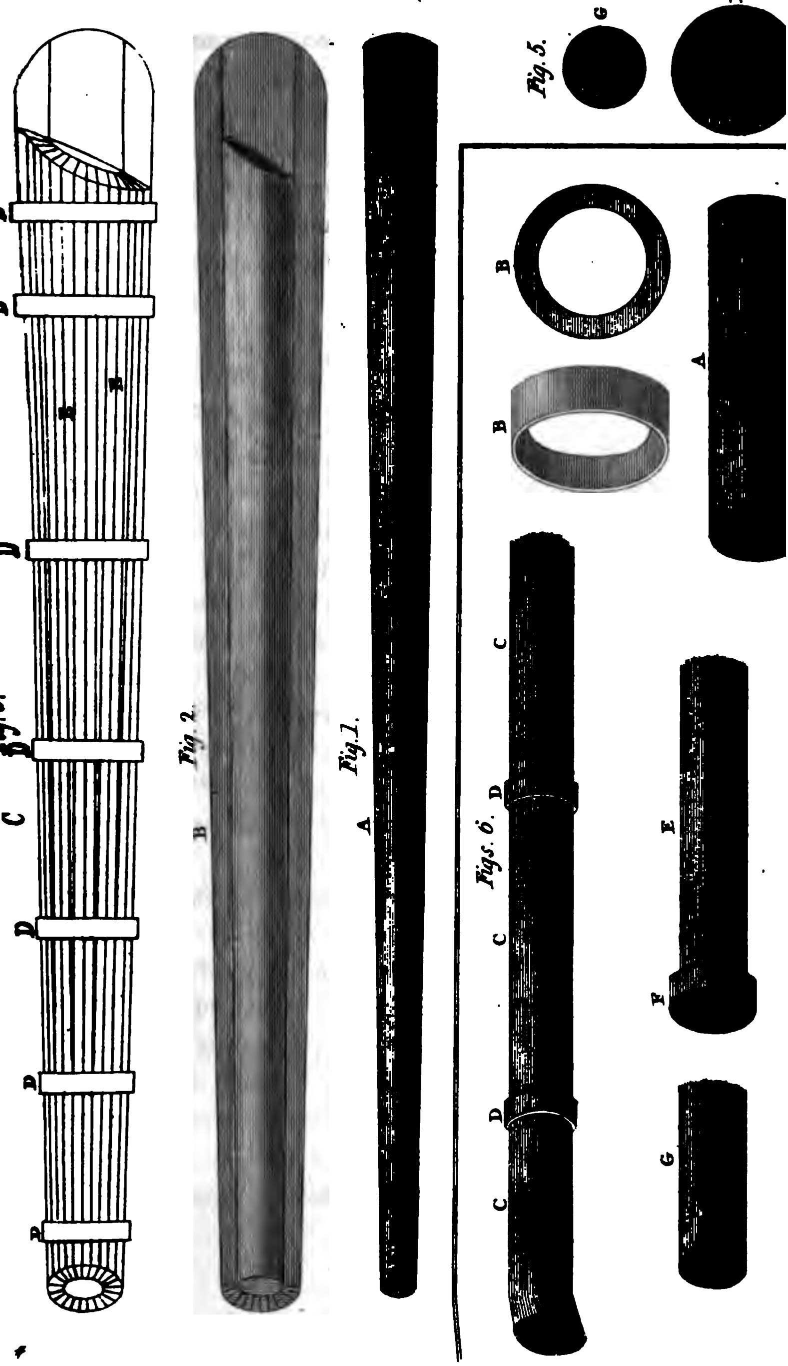
In all large bodies of wrought iron required to be straight from end to end, the solid core should then be straight, and the bars of feather-edged iron should be used and applied round the same, as before described, without any splices of iron being necessary.

In witness whereof, &c.

OBSERVATIONS BY THE PATENTEE.

By the foregoing Specification the Patentee trusts it will appear that this invention will save a considerable quantity of iron, coals, and labour, in the manufacturing of large bodies of wrought iron, and materially add to the strength and soundness of the same. To prove this, it may be necessary to state in what manner iron was heretofore made up and used for the purpose of making the shank of a large anchor, or any other large body of iron of a similar form, which was by using loose pieces of iron, commonly called gut iron, for the centre, and placing bar iron round the same, making a body of iron of much greater weight than the article required when manufactured, so that the loss of iron in large manufactured bodies was very considerable. And, besides this, the body of iron being so much more heavy than the same should be when finished, and requiring to go through the fire so many more times, in order to reduce it to its proper size and form, it may easily be conceived that the labour and consumption of coals must be proportionably increased. Now, by the invention in question, it is only necessary

Pl. XII. Vol. XIX. Second S



necessary to lay up about one-tenth more iron than the weight will be when manufactured. By using the solid core for the centre, and the feather-edged bars placed round the same, which forms a round body of iron before it goes into the fire of nearly the form required when manufactured, the whole body only requires a sufficient number of heats to weld the same together, which is effected by full one-third less than the number required by the old method; so that it is obvious that the saving in coals and labour must be very considerable: and it is a well-known fact, that the less the number of heats given to wrought iron (so as it be made sound) the stronger it will be. By this method the centre part of the body will be perfectly sound and entire when the same is finished; whereas by the old method, as we have before stated, the centre being composed of many small pieces, and by necessarily passing through the fire so often before the whole was manufactured, becomes loose and unconnected, and the outside of the shank, from the same cause, becomes very much impoverished.

This invention, I flatter myself, will be considered of great importance to the public, particularly to the navy and the shipping interests generally, as it tends not only to reduce the price of articles of the first consequence, but adds considerably to their strength, and of course to that security so desirable in the commercial world.

Specification

Specification of the Patent granted to Samuel Hill, *Serle-street, in the County of Middlesex, Esquire; f a Method of joining Stone Pipes in a more effect Manner than had been before discovered.*

Dated July 3, 1810.

With an Engraving.

TO all to whom these presents shall come, &
NOW KNOW YE, that in compliance with the said provi I the said Samuel Hill do hereby describe and ascerta the nature of my said invention, and the manner which the same is to be performed, as follows; that to say: I cut a piece of stone, of any length, bore, a external dimensions, into rims or collars, as represent at A, (see Plate XII. Figs. 6); from thence I take a coll as at B, and join it at the end of the pipe, as at E, w a cement, the external diameter of the pipe E being little smaller than the bore of the collar, to allow t cement to lie between the collar and the pipe; and put the collar only half way on the pipe, the other h projecting to receive the pipe that is to be joined to t one on which the collar is already fixed; for instan if the collar B or F be four inches thick, I put two incl on the pipe E, leaving a projection of two inches to ceive the pipe G. I then take the pipe G, and ins one end into the projecting part of collar F to meet pipe E, taking care to spread sufficient quantity of ment in the internal part of the collar F, and on external part of the end of the pipe G, to be inser so as to prevent any water from passing through joints, and the pipes when joined will appear as C C

T

That the collars, although represented by the drawings in the margin to be circular, may be of any shape, both externally and internally. And it is to be observed, I do not take out this Patent for any particular shape of the collar, or any particular manner of forming the collar, but for the mode of joining the pipes by means of a collar; all which I claim as new, and invented by me. And I have set forth the same particularly, in order that my said invention may be completely disclosed and understood, so as to be put in practice by others when my Patent expires.

In witness whereof, &c.

Specification of the Patent granted to SARAH GUPPY, *Wife of* Samuel Guppy, *in the City of Bristol, Merchant; for a Mode of erecting and constructing Bridges and Rail-Roads without Arches or Sterlings, whereby the Danger of being washed away by Floods is avoided.*

Dated March 4, 1811.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Sarah Guppy do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: On each side the river or place over which a bridge or road is to be constructed pursuant to my said invention, I do fix or drive a row of piles, with suitable framing, to connect them together; and behind these I do fix or drive and connect other piles, or rows of piles, and suitable framing; or

or otherwise, upon the banks of the said river or place, I do dispose or build certain masses of connected masonry, or other ponderous structures, with piles or without, in order and to the end that the said piles or masonry, or other structures, shall be capable of sustaining and permanently resisting the action of a considerable force applied or exerted in directions tending to bring the same together. And I pass across the said river or place, from the upper or other convenient part of the said piles or masonry or structure, several strong metallic chains, parallel to, and at suitable distances from each other, which said chains may be drawn tight by secure mechanical means, or otherwise the said chains may be suffered to hang in similar lines, slightly curved from the one side or bank to the other; and in either case I do dispose upon the said chains, longitudinally and crosswise, such fit pieces of timber or iron, or other suitable materials, as shall and may constitute a platform, which, by the connection or disposition of the materials thereof, shall afford a proper support for a road or pavement of the usual structure, or for rail-roads; which last, namely, the rail-roads, upon such occasions as may require the use and application of my said invention, I do connect, unite, and frame together with each other, and with the chains hereinbefore mentioned and described.

In witness whereof, &c.

On Wheel Carriages.

By Mr. Booth, *of Allerton, near Liverpool.*

(Concluded from Page 176.)

EVERY person ought to enjoy the unrestrained and unlimited use of the powers and capacities of his cattle in the fullest extent; to abridge this right would be as impolitic, in a national view, as it would be unreasonable and unjust to the individual. The Legislature has only to guard against the roads being injured by the use of improper carriages. This may be completely effected by the adoption of a single principle, simple in its nature, unexceptionable, and of universal application, and which will at the same time totally supersede the necessity of having machines for the purpose of weighing carriages with their loads. It is, that the breadth of the wheel shall be in proportion to the number of horses in the carriage.

A strong horse will in summer, when the roads are good, draw 35 cwt. including the carriage; in winter less, in proportion as the roads are worse; and if the wheel of the cart be five inches broad, the roads can never be injured by such a cart, drawn by one horse. It is only equal to 3½ cwt. on every inch in each wheel. By the schedule A, page 8, in the Report of the Committee of the 30th May 1809, 30 cwt. is allowed for a cart with three-inch wheels in summer, which is equal to a pressure of 5 cwt. for every inch in breadth of the wheel. In a cart with nine-inch wheels two horses may be allowed, and with thirteen-inch wheels three horses, without injury to the road.

It is almost superfluous to mention, that carriages may be constructed so that their weight shall be in proportion to the weight they are intended to carry; that is, in proportion to the number of horses by which they are drawn. It is not the interest of the proprietor to use four horses in a cart; it will be more advantageous to use them in a waggon, or with two carts. As a waggon is in effect only two carts connected together, it may be allowed double the number of horses allowed to carts, as stated above, with wheels of the same breadths as the cart wheels, and the roads will be no more injured by waggons than by carts. Those persons who have small and weak horses will of course construct their carriages, so as their weight and strength shall be in proportion to the weight of the loads they are to carry.

Suppose a person has three weak horses in a cart, (one of the most unfavourable cases that can happen,) the wheel will be thirteen inches broad, but if the rim be properly constructed, that is, made no heavier than necessary, the additional draught this will cause to each horse will only be about one pound more than with the wheel of three inches broad, but this will be more than counterbalanced by the greater ease of draught with the broad wheel, particularly so in the improved state of the roads, which will be the necessary consequence of the entire exclusion of narrow wheels. Thus it is evident in the most unfavourable case, that the adoption of the broad wheel will be for the benefit of the proprietor of the weakest horses that travel the road; and it will be equally or more so for those who possess the strongest horses, as it will afford an opportunity of using their power to the utmost extent on all occasions, without limitation or controul in any respect. There does not appear

appear to be any rational or solid objection, either on the part of the public or of individuals, to the adoption of the rule as explained above, and by which weighing machines will, it is evident, be rendered totally unnecessary. As the heaviest and strongest horses can never be used with advantage in stage-coaches, on account of their rate of travelling being about three times greater than that of waggons and carts, the wheels may be narrower than those of these latter, without injuring the road. In a stage-coach, therefore, two horses with five-inch wheels, four horses with seven-inch wheels, and six horses with eight and a half-inch wheels, cannot injure the road with any load they can draw in a trotting pace, as the horses will never be of the strongest kind, as already noticed.

Post-chaise travelling for hire, with two horses, the wheels to be five inches; with more than two horses, six inches.

Giggs, &c. with two wheels, travelling for hire, to have wheels five inches broad. The adoption of the principle here recommended will have a natural tendency to improve the breed of horses, a circumstance of no small importance.

The hind wheels of four-wheeled carriages are in general probably of the best or most advantageous height with respect to ease of draught for travelling on roads in their *present* state; it therefore necessarily follows, that the fore wheels ought to be of the same height as the hind, with respect to ease of draught; the convenience of *turning*, however, requires that they should be less: but it is an important truth, and which ought to be impressed on the minds of the proprietors of such carriages of every description, that as the height of the fore

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fore wheels is diminished for the sake of *turning*, the fatigue or labour of the horses in the day's work or journey is increased; therefore, the nearer the fore wheel approaches to the height of the hind, the more advantageous it will be in point of draught.

Mr. Cumming has made various observations on the properties of wheels of different diameters, all of which are very correct, and familiar to every one conversant with the subject; but they only relate to wheels moving on perfect planes, but are inapplicable to the case of wheels moving on the roads as they actually exist; and Mr. Orr's opinion, that the power is increased by the increase of the diameter of the wheels travelling on such roads, is in reality perfectly right; though, perhaps, if his ideas on the subject had been conveyed in more popular language, they would have been more clearly comprehended by persons in general not well versed in subjects of this nature. Suppose a loaded one-horse cart, with wheels of fifteen inches diameter, and the utmost power the horse can exert for two or three seconds of time, to be equal to 320lbs. that is, he can act for that time against a resistance equal to this weight: now suppose obstacles in the road occur that require a power equal to 330lbs. to surmount them, it is evident that the horse could not draw the load over the very first obstacle of this kind that occurred, and of course he would not be able to proceed with the load an inch farther; but suppose the wheels were five feet and a half diameter instead of fifteen inches, the horse would draw the load over these obstacles with ease, as in doing which he would only have occasion to exert about one-fourth of his power or strength. Increase the diameter of the wheel from fifteen to eighteen inches: in this case the horse

horse will be able to surmount the obstacle, but it will require nearly the exertion of his whole power; and these obstacles frequently occurring, he would soon become so exhausted as not to be able to surmount them at all. Keep increasing the diameter of the wheel, and his power or ability to surmount the obstacles with more ease to himself will keep increasing also, till the diameter of the wheel approaches to five or five feet and a half, which is probably the most advantageous height, in point of draught, in the present state of the roads. Suppose the diameter of the wheel to be only three feet, it is self-evident that the horse would be more fatigued at the end of his day's work or journey than he would be if the wheel had been five feet and a half high. The fact unquestionably is, that the high wheel *empowers* the horse to perform his day's work with greater ease to himself: and, therefore, it may with the strictest propriety be said, that the increase of the diameter of the wheel increases his power. It is almost superfluous to observe, that the *duration* of the exertion of the horse increases in surmounting an obstacle as the diameter of the wheel increases, yet at the same time the power requisite to surmount the obstacle decreases, by which the excessive exertions which exhaust the strength or powers of the horse are moderated, and he is enabled thereby to perform his work with more ease to himself, as demonstrated above.

I have shewn above, that it will be the interest of the owners of one-horse carts to have the wheels five inches broad; and to those who use two horses in a cart, it will be equally their interest to have the wheels nine inches broad; for the increased draught of each horse, occasioned by increasing the breadth from five to nine inches, will

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will be only a few ounces, a difference scarcely worth noticing; while, on the other hand, the proprietor will be entitled to carry as great a load as his horses can draw; and two strong horses, on hard and level roads in summer, especially in their improved state, (which will be the necessary consequence of the use of broad wheels only,) will draw a load of 70 cwt. particularly in short journeys, carriage included; whereas at present, with three-inch wheels and two horses, he is not allowed, nor intended to be allowed, to take a load exceeding 30 cwt. in summer, and 25 cwt. in winter, carriage included; though his horses may be able to draw double this load without being fatigued more than prudence would justify. If the felloes of a nine-inch wheel are properly fashioned, that is, in the manner of those in the wheels of what we in the country call the London waggons, the whole of the felloes in a wheel of five feet diameter need not exceed 48 lbs. in weight those of the five-inch wheel; and as the thickness of the tire of the nine-inch wheel may be proportionably thinner than that of the five-inch wheel, the weight will be nearly equal; the increased draught, therefore, will be very insignificant, as shewn above. If farmers and carriers were well-informed, and convinced of the foregoing truths, which admit of the clearest proof, they would feel no reluctance to the adoption of broad wheels, as it would afford them the opportunity of frequently doing double the work with their horses that they now perform, and at all times more, as they would be enabled constantly to employ the whole strength or powers of their horses. They would frequently, at twenty loads with two horses, carry seventy tons, including the weight of the carriage; whereas at present they are only allowed to carry thirty

tons

tons in summer, and twenty-five tons in winter, carriage included, at twenty loads, though their horses may be of the strongest kind. The loss, however, sustained by the present improvident laws respecting the weight allowed to be carried in waggons and carts is not so much that of the farmer or public carrier, for the former cannot pay a higher rent than what his industry and a decent maintenance admit of; and therefore the loss occasioned by impolitic laws, preventing him from making use of the full powers of his horses, falls upon the landlord, who otherwise would obtain higher rents; and the same may be said of the public carrier, for he must charge such a rate of carriage as will afford him a livelihood, and the public must pay it. The loss occasioned by such impolitic restrictions is sustained by the commerce, trade, manufactures, and agriculture of the country, and not by the individual farmer and carrier, as shewn above.

To sum up the whole; true policy demands that every person should be allowed the unlimited use of the powers of the horse to their fullest extent, the Legislature directing that the wheels of carriages shall be as broad as a due regard to the preservation of the roads shall require; and if it should be thought that the breadths proposed above are insufficient for this purpose, it can enact, that they shall be of such breadth as in its wisdom shall be deemed necessary.

Method of boring the conical Part of Brass Cocks.

By Mr. CHARLES WILLIAMS, *of Gravel-lane, Southwark.*

With a Plate.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

Twenty Guineas were voted to Mr. WILLIAMS *for this Invention.*

HAVING been for some time engaged in the business of making large brass cocks, for drawing off liquors, I found a very great inconvenience in boring the conical part, especially with the water-way cast in them. This circumstance suggested to me the necessity of a method of manufacturing them with more facility than had hitherto been practised.

I have since constructed an apparatus for boring such cones with as much ease and accuracy as cylindrical bores of any calibre, in a correct, simple, and handy manner.

REFERENCE TO THE ENGRAVING.

This apparatus is adapted to be fitted to any common turning lathe, with a few trifling additions. A, Figs. 1 and 2, (Plate XIII.) is the foot-wheel of the lathe. B the cheeks, C the mandrel, and D the front puppet. The piece of work in which the conical aperture is to be bored, E, is fixed on a screw at the end of the mandrel, so as to revolve with it in the usual manner of turning; a small pin is screwed into the end of the mandrel, as shewn in the plan, Fig. 2, which has a spherical head,

and

and is received into a suitable cavity in the end of a square iron bar F, which is of sufficient length to extend to the front puppet D. At this end it has a sort of crutch or cross head *a b*, composed of two pieces, lying parallel to each other, and united by two screw-bolts, which, being fitted into oblong holes, admit a small lateral motion of the piece *b*, by the side of *a*; but they can be firmly held together by drawing the bolts tight: the piece *a* is formed from the same piece of steel as the bar F; and the other, *b*, has several holes bored in the far side of it, to receive the point of the screw of the front puppet D: these holes are at equal distances from each other, so that by introducing the screw in one or other of them, the bar F can be inclined to the axis of the mandrel, and by releasing the screws which unite *a* and *b* a finer adjustment can be made of the intermediate spaces between the holes, so as to incline the bar F in any angle within the limits of the length of the cross *a b*. The bar is supported by an iron frame G, screwed to the front puppet, and it is kept from rising by an iron clamp *d*, attached to G, and extending over *a b*; it at the same time serves as an index to divisions upon *a*, which determines the angle of F and C.

Upon the bar F two cylindrical sliders, H and I, are fitted, to slide as freely and accurately as possible; the former is provided with a steel-cutter or tooth X, projecting a small quantity from its circumference, and it is this which performs the cutting or boring within the cone E, fixed to the end of the mandrel. The cutter slider H is connected with the slider L by two iron rods *e e*, and I is moved along the bar by a lever K, which has a large opening or eye through it, to admit the slider I, and takes its bearing against two pins *f f*, fixed in the

 slider.

slider, and passing through holes in the lever ; the
is supported by an iron plate L, Fig. 2, having s
holes to receive a short pin projecting upwards fro
end of the lever. The plate L is supported by two
gg, Fig. 1, which are bolted to two wooden block
jecting from the far side of the cheeks B : one of
bolts (see Fig: 2) is passed through an oblong h
the leg, so that the plate L can be moved backwar
forwards to be always parallel to the bar F. The
ner of rising this machine scarcely needs any ex
tion, the work being put together as above desc
and with a cutter X adapted to the size of the c
be bored ; the workman hooks the pin at the end
lever K into any of the holes in the plate L, and b
means gains a power to thrust the cutter forward
the cone, by pressing the end of the lever towar
mandrel, which is at the same time revolving wi
work to be bored or turned out to a true cone b
cutter X ; and it is evident that any number of c
which are afterwards to be turned by the same m
will be precisely of the same size and angle.

Calculations respecting the Produce of Land in Arti *Human Sustenance. By Mr.* William Pitt.

From the Communications to the Board o Agriculture.

An acre of land in potatoes well managed will
duce 300 bushels, of 80 lbs. each. Deduct t
bushels for seed ; remain 280 bushels, nett produc
ten tons weight of food fit for the human species.
root at present stands first in the weight of h

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Pl. XIII. Vol. XIX. Second Se

Fig. 1.

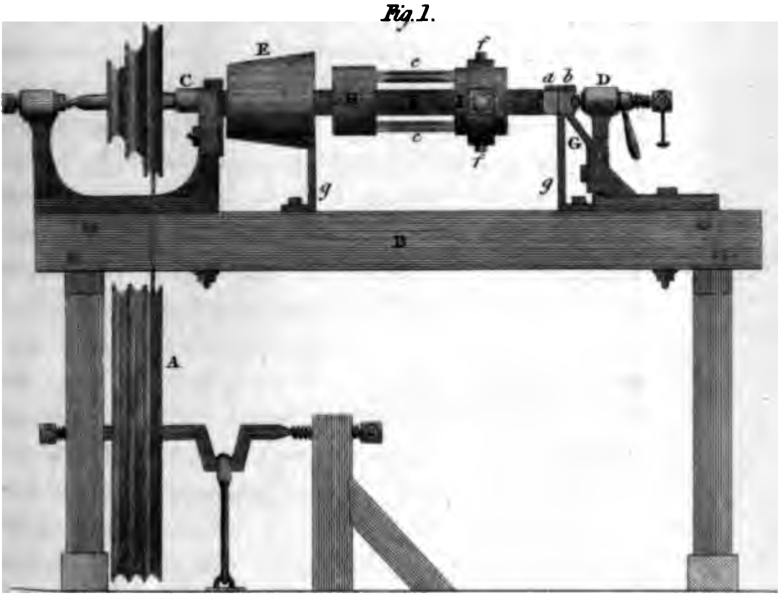
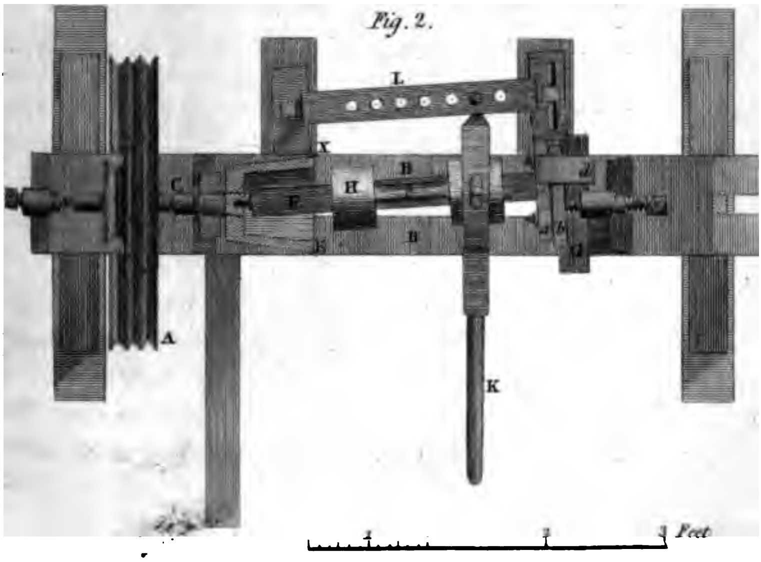


Fig. 2.



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food to be produced from an acre of land, as above, ten tons.

Wheat.—The produce of wheat in the best cultivated land may be reckoned four quarters *per* acre; in the common fields and ordinary land, two quarters; average, three quarters. Deduct two and a half bushels for seed; remains nett average produce twenty-one bushels and a half *per* acre; which at nine gallons measure should weigh 67 lbs. *per* bushel. Weight of wheat produced *per* acre will thus be 1440 lbs.

No deduction is here made for loss of land in the fallow year, very little land being here fallowed for wheat, and that little ought to produce above average, as having fewer weeds to support.

No other grain or pulse will exceed wheat here (Leicestershire) in the weight produced of good wholesome human food.

I estimate that two sheep, of 20 lbs. *per* quarter each, is all the mutton to be expected from grazing an acre of prime land, breeding the sheep on the premises; to this is to be added the head and pluck as eatable food. If we reckon beef or pork to grow somewhat faster than mutton, in proportion to the breadth of land they clear, the quantity of animal food produced from an acre may be 180 lbs.

Dairy Produce.—A good dairy cow will produce annually of cheese 480 lbs.; of veal, supposing every other calf fatted to 30 lbs. *per* quarter, 60 lbs. Suppose this produced for five years, from three years old to eight, this gives 2700 lbs. in five years. If fatted the sixth year to 165 lbs. *per* quarter, 660 lbs. of beef is to be added. Charge the rearing three years at half price, and allow one half-year's keep for whey and pork, not

[redacted]

reckoned before: remains seven years keep, and 3360 lbs. weight of animal food produced, or 480 lbs. weight *per annum*. But this cow will consume the produce of two acres of prime land annually, and therefore only produces of animal food *per* acre annually 240 lbs.

If we suppose the food thus produced to be equal in value and nutriment to mutton, beef, and pork, or the average of them weight for weight, then the produce of grazing is to that of dairying as 140 to 280, or as 3 to 4; and one-fourth of the produce of dairying is raised by the extra labour therein employed.

The idea of grazing for one year an acre with feeding cattle, being in produce equal to 180 lbs. of beef, is founded upon the estimate of the profits of breeding and grazing sheep being equal thereto; and the grazier's experience will keep these things at par, as he will always increase that stock that pay him best; the hides and offal of both are thrown in, as being in produce and amount nearly analogous: it must also be observed, that these calculations are made for good Leicestershire grazing land.

Oxen.—The ox bears no comparison to the cow or heifer in the nett produce of human sustenance; for if we suppose a bullock's keep equal to that of a cow, and that he be kept to eight years old, and throwing in the first year, call the whole seven years keep, there will then be a great deficiency compared with a cow or heifer; but graziers generally reckon upon buying in store oxen or steers, at a cheaper rate than they can rear them, from cheaper and less improved countries.

If we take the average weight of a fat full-grown ox at fourteen score the quarter, being the mean between twelve and sixteen, then the produce of that ox for seven

seven years keep will be ....1120 lbs.
weight of beef; but the produce of a cow, as
before, is 3360

Superiority of the cow to the ox in animal food 2240

Query.—Will this deficiency be made up by the animal working four years, *viz.* from three years old to seven? which is all that can be reckoned upon, as the last year must be reckoned solely for feeding up. As beef or cheese has sold latterly, this deficiency would be 2240 lbs. at 7½*d.* 75*l.*

And if the data of these calculations are supportable, it is evident that, for an ox to be as profitable as a cow, the above difference must be made out by his labour. If farmers could be convinced that this can be done, and that an ox can work as well as an horse, there would then be no difficulty in persuading them to substitute oxen for horses.

In the above calculation, fourteen acres of good land are allowed for the support of an ox, and feeding him up, at from seven to eight years old, which is two acres *per annum* for his full grown state, and one year thrown in.

I would allow an horse when full grown three acres, *viz.* one for corn, one for hay, and one for grass, and for his immature years the same proportion as the ox: then at eight years old he will have consumed the produce of twenty-one acres against the ox's fourteen; or two horses consume the produce of as much land as three oxen: whence it is necessary, if horses are the most profitable, that two horses should do more work than three oxen, because the oxen will at the end of the eight years be of greatest value.

But

But it is believed by farmers, that two horses will do as much work as four oxen: and farther, that there is a variety of business connected with a farm that oxen cannot do at all; also, that as horses are in demand, and cannot be had unless bred somewhere, it is necessary to breed them; and who can breed them but the occupier of land, who can also work them or sell them at pleasure?

It will have appeared above, that both oxen and horses are, considered in themselves, unprofitable stock, in comparison with cows; but being necessary for their labour in cultivation, the loss in keeping them must be made out by the profit in corn and grain raised by such labour.

Human Species, their Consumption of landed Produce.

I reckon that a healthy grown person of the male sex, who uses much exercise, and who has what he chooses at command, will consume in bread the produce of a pound weight of flour *per* day, or 365 lbs. *per annum*: this, allowing for the bran, will be the product of one-third of an acre, according to the produce *per* acre before stated; and allowing for potatoes and other vegetables, will consume in vegetable food .... ½ acre;

and in animal flesh, at ½lb. *per* day, 182½ lbs. *per annum*, or the full produce of ....1 acre;

and in butter and cheese the product of .... ½ acre.

(I suppose butter produced only in half the proportion of animal flesh, or 90 lbs. *per* acre *per annum.*)

And in beverage from malt liquor the produce of at least one acre of barley ....1 acre.

In all, supposing the land of good quality, the produce of..3 acres.

The

[redacted]

The allowance for beverage may by some be thought high, but the home-brewed ale of my neighbourhood has six bushels of malt at least to a forty-gallon cask; so if a person drink only four pints of ale *per* day, it is 182½ gallons *per annum*, or the produce of full twenty-six bushels; a trifling allowance for small beer at meals will raise it up to the produce of more than an acre. I believe I can find people in plenty who would undertake to drink double this quantity, and many who really do so.

For the female sex who are grown up I would deduct the beverage, and allow them each the produce of 2 acres.

And for those beneath the age of puberty of either sex *per* head the produce of 1 acre.

In order to ascertain the breadth of land necessary to support any given number of the human species I would divide them into three classes, in equal number, as above; 1. the male sex grown up; 2. the female sex grown up; 3. children of either sex; and one of each, as above, will consume the produce of six acres, or two acres *per* head *per annum*.

If we suppose the number of horses kept for draught, harness, the saddle, and all other purposes, to be equal to one-tenth of the number of human beings; and that each horse, as before calculated, consumes the produce of three acres of good land, then thirty persons and three horses will require sixty-nine acres; to avoid fractions I will say seventy acres of such land; and suppose sixty acres go to support thirty human beings, and ten acres to the three horses, thus the horse consumes one-seventh part of the produce of the land, and the human species six-sevenths.

But

But this calculation is made for the prime soils of Leicestershire; to adapt it to the whole kingdom, I would divide the land into three classes, and suppose one-third of it as good as Leicestershire, one-third only half as good, and one-third a medium between the two; then the breadth of land must be increased as two to three, or it will require 105 acres of the average land of the kingdom, in its present state of cultivation, to maintain thirty persons and three horses, or three acres and a half *per* head upon the whole number of human beings.

By this calculation, seven millions of people living as is the custom now in England, would require twenty-one millions of acres of land cultivated for their own subsistence, and three millions and a half of acres for the horses kept for their convenience, their luxury, and their pleasure.

I know some people will object, that the allowance of land for horses is insufficient, and that the produce of much more land is consumed individually by that animal; and so it may where they are kept in luxury; but I know that thirty bushels of oats, together with the grass and hay from the proportion allowed of medium land, will well support a working farm horse, and that if more is given to hunters, and others who make great exertions, less is also given in many cases. The same observation will hold good respecting the human species, where the luxury and extravagance of some are counterbalanced by the abstinence or poverty of others.

If the above data were correct, it seems not difficult to deduce from them the due proportion of cultivation of different articles to suit the present modes of living; or to point out such economical alterations as tend to

support

support a more numerous population: thus a farm of 210 acres of medium land is to support sixty human beings and six horses; for the former,

Wheat will be wanted upon	20	acres.
Barley at least upon	20	
Oats for the horses upon	10	
Beans and peas for hogs and other stock upon	10	
Potatoes or turnips or green crops upon	20	
Wheat fallow upon	10	
Horse pasture	10	
Cow pasture	40	
Sheep pasture	40	
Horse hay on 10 acres, cow hay on 20	30	
	210	

From this calculation it should appear, that, to supply the present demand, near one-tenth of cultivated land should be sown with wheat, and the same proportion with barley; that two-sevenths of the whole breadth of land should be cultivated for grain or pulse, one-seventh green crops of fallow, three-sevenths pasture for live-stock, and one-seventh mown for hay.

It also appears that a much greater population may be supported from the same breadth of land, upon vegetable food, and the produce of cows in milk, and its produce, than can upon animal diet, and fermented liquors used as beverage; and that these two latter are almost equally a luxury; as an individual, by indulging in either the one or the other, may clear off the produce of nearly an equal breadth of land.

Since writing the above, I have met with the follow-

 ing,

ing, in Dr. Darwin's Phytologia, which I beg leave to introduce:

"Mankind are by nature partly carnivorous and partly graminivorous, proved by this analogy — the Gentoo tribes who live solely on vegetables, and the fish-eaters of Greenland, are a feebler generation than those of these parts of Europe who partake of both animal and vegetable food."

"But it is good policy in governments to prevent mankind becoming too carnivorous."—Spirits from grain and strong ale are called chemical poisons, thinning the ranks of society, both by lessening the quantity of food and shortening life by disease.

"If the luxurious intemperance of consuming flesh meat principally, and of drinking intoxicating liquors, should increase among us, it will thin the inferior orders of society by scarcity of food, and the higher ones by disease both of body and mind."

The encouragement of our fisheries, and of the use of fish as an article of diet, seems a great desideratum; as wholly preventing, as far as it goes, the consumption of landed produce. The importation of every wholesome article of diet or beverage that can be paid for by our manufacturing labour, should be encouraged till the stock in hand of our own productions is restored, which will be sufficiently indicated by the price at market; but that price must not be expected to come to the standard of former times; as, with the present load upon landed property of taxes, parliamentary and parochial, together with the advanced rate of every article purchased, and of labour in cultivation, it must in average seasons stand in a considerable higher proportion than before

before those additional burdens existed; and in all human probability, unless some unforeseen causes or circumstances should intervene, the average price of every article of landed produce, for seven years to come, must be considerably higher than the average price of the same articles for seven years preceding the late war.

Particulars regarding the Merino Sheep, imported by CHARLES DOWNIE, *Esquire, of Paisley, in Scotland; in Answer to certain Queries, transmitted by Sir* JOHN SINCLAIR, *to the Spanish Shepherds who have the Charge of them.*

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

THE sheep in question, the number of which amounted to 103 rams and 146 ewes, left Lisbon on the 10th July 1810, and they were landed at Port Glasgow on the 6th of August following. During the voyage fourteen rams and four ewes died: but on-board of another ship, having also a cargo of sheep, amounting to 150 rams and 200 ewes, which sailed from Lisbon at the same time, and reached Port Glasgow six days sooner, only eight rams and four ewes died, the vessel being larger, and the sheep having more air. Since they landed, up to the 21st August, twelve rams and five ewes of both cargoes have died, and about seven more of both flocks are likely to follow them. During the voyage they were fed on barley and hay; and care was taken to keep the water, put on-board for them at Lisbon, as fresh as possible. The best time to import Merino sheep into this country is, when the weather is the most likely to be dry

 and

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and warm on their arrival here; and they ought to be brought over in large ships, affording them room and air.

The ram in a good season will produce about twelve pounds of wool; the ewe, having had a lamb, about five pounds; having had no lamb, about seven pounds. The wether about nine to ten pounds. The wool was formerly worth only about two shillings *per* pound; but of late years the price has doubled. The sheep are fed on the mountains of Estremadura in winter, and on those of Leon in summer. Those imported by Mr. Downie are of the Paular breed, which formerly belonged to the Prince of Peace or Godoy. The reason of their change of pasture is, to avoid the excessive heat of the south of Spain in summer, and the cold of the northern mountains in winter. This change of climate preserves, it is believed, the health of the sheep, and consequently the fineness of the wool.

In Spain there are many rams without horns, and they could as readily be got over as the horned. The Spanish shepherds who attend Mr. Downie's sheep have seen flocks of rams without horns; and think that they are in every respect equal to those having horns.

The diseases to which the Merino sheep are chiefly subject are, 1, what in Spanish is called *La Rona*, a disease on the skin; and, 2, what the Spaniards call *Convalencia*, which appears in a tumour, or swelling under the chin. This is caused by bad grass, or bad water, or by feeding at night, which is reckoned a very bad practice: that disease is incurable. The specific cure for the rona is the *black oil*, a substitute for which is water in which tobocco has been boiled. The Merino sheep are also

also liable to the foot rot. It is caused by the sheep feeding or sleeping on wet or damp ground. The remedy is the same, *black oil*, which is called in Spanish *Miera*. It is extracted, the shepherds know not how, from a tree called *anevro*, which, from their account of it, seems to be a species of fir. The oil may probably be procured from Cadiz, although at some distance from the sheep country. The shepherds do not know whether it be used for any other purpose but for the diseases of sheep.

The Spanish shepherds, as far as they can judge, are of opinion, that the Merino sheep, under a careful and intelligent shepherd, would thrive in Scotland. By an *intelligent* shepherd, they mean one who is acquainted with the various diseases to which the Merinos are subject, and with the cure of those diseases; and who also knows the proper pasture, which should be dry, consisting of natural rather than of sown grasses, and free from noxious herbs. By a *careful* shepherd, they mean one who not only leads the sheep to a proper pasture, *but who every day examines them one by one*, and is thereby enabled to arrest, in its beginning, any of the diseases to which they are subject: he must also pay the most assiduous attention to his flock, both night and day, during the time the ewes are lambing. With no more care than what is bestowed on sheep in the West of Scotland, they apprehend that many of the Merinos would die before Christmas.

In dry hot weather salt is given to the Spanish sheep. It is given well pounded, and sprinkled on the plain surface of some stones, which the sheep lick with their tongues. It serves to strengthen and fatten them.

In

result. Then, considering separately in this operation the component parts of the vegetables, he directs his attention exclusively to the three kinds of fermentation, called panary, vinous, and acetous. Following the author in this arrangement, I shall apply myself to bring forward the most interesting facts.

On the Panary Fermentation.

The fabrication of bread, which nourishes nearly all the population of Europe, is properly a chemical operation, since the nature of the substances are changed that furnish this most necessary aliment.

These substances are united in the meal of farinaceous seeds, especially in that of wheat, which is known to produce the best bread. M. Chaptal finds in flour of this grain starch, gluten, mucilage, and sugar; to which we may add the leaven, vegetable albumen, calcareous phosphate, &c. which appear to be among the materials that compose it.

With respect to the action of each of these bodies in the panary fermentation, it is a general opinion, that the flour being reduced to a paste, the saccharine mucus *(mucoso-sucré)* undergoes the spirituous fermentation, the starch approaches to an acid, and that the gluten and albumen become putrefied. I shall not entirely adopt this docrine. It seems to me, that it would be more accurate to state, that the leaven after having converted the sugar of the flour into carbonic acid gas and alcohol, changes this grain into acetic acid; that at the same time the gluten and albumen being decomposed, produce, besides the acetic acid, ammoniac, carbonic acid, &c. and that the starch, uniting with the undecomposed gluten, thus produces a composition of which

which the further alteration is prevented by baking, which more intimately combines the principles.

This theory of the panary fermentation appears to me to be supported by the following facts.

First. The flour when destitute of leaven and that which contains scarcely any, always produce heavy bread, although the saccharine mucus forms a part of it; for this body not being a fermentable principle, will not ferment of itself, though it can be made to ferment by means of the leaven.

It is customary to add to the paste a leaven taken from paste already made, or the yeast of beer.

Secondly. The paste is constantly acid, notwithstanding the volatile alkali produced in the operation neutralises a part of the acetic acid, as is proved by the ammoniacal smell of the paste when treated with potash. The bread itself retains a little of this acid, which heightens its flavour.

Thirdly. The starch, the undecomposed gluten, and the other materials, are so perfectly united by the baking, that it is no longer possible to separate them. By distillation animal matter is discoverable in bread, which is formed from the ammoniacal acetate; but a less quantity is obtained from it than from the flour, according to M. Vauquelin's observation.

Fourthly. The formation of carbonic acid gas is rendered evident by the bulk the paste acquires, and the numberless cavities it presents. This gas in escaping when the bread is baked dilates the mass still more, which permits the air to lodge in these cavities: this is a very important circumstance, as it is said to occasion that remarkable whiteness in bread that is porous, and is light and delicate, compared with bread that is not

porous, which latter is heavy, close, and disagreeable to the taste.

Thus the leaven is the most active principle in the operation of bread-making. When added to the paste in too small a quantity the operation is slow and incomplete; when too much is employed the fermentation is so great that it is necessary to put a stop to it. In the latter case, M. Chaptal proposes, in imitation of Edlin, to knead carbonate of potash with the paste, which neutralises the excess of acetic acid produced. Good managers content themselves with uncovering the paste, dividing and exposing it to the air, in order to diminish the temperature of the fermenting mass, and this is sometimes successful.

Of the Vinous Fermentation.

This operation cannot take place without the presence of sugar, leaven, and water. The sugar is the fermenting body, the leaven is the agent, and water is a necessary condition, as well as a certain temperature. It is because these three bodies are combined in all sweet juices that these juices are capable of vinous fermentation.

We come next to consider the chemical changes which take place in substances submitted to the vinous fermentation. If we take an account of the composition of these substances, and of those obtained in this operation, it will be easy to imagine, with M. Thenard, that here the leaven carries to the sugar a very small quantity of oxygen, which forms in it a body *sui generis*, the principles of which being disorganised by their own reaction, are combined in another order, and produce alcohol dissolved in the water and carbonic acid gas. The leaven

leaven that excites all these phenomena being itself partly changed, precipitates; whilst the water serves merely to facilitate the contact of the molecules, and to retain the alcohol.

The methods used to prepare the different substances for the vinous fermentation are reduced, according to M. Chaptal, to decoction and expression. The first is performed by means of water, in the fermentation of the farinaceous seeds which furnish beer; the other is employed in the fermentation of the juices that produce the various sorts of wine. The details given by the author, on the preparation of beer being borrowed from Thomson, I shall not analyse them, particularly as I have a great number of facts to relate on the art of making wine.

On the Vinous Fermentation of the Juice of Grapes.

The sugar and the leaven exist separate in the grape: thus it is necessary to tread this fruit, in order to obtain the juice called *must*, in which these two compound vegetables are mingled together.

The *must* fermenting very fast at the temperature of $12^{\circ}+0$, M. Chaptal makes it essential to fill the vat quickly, in order to avoid the successive fermentations that take place when it is several days filling, which he says inevitably makes wine of a very bad quality. This may be the case in the northern countries, where their less sweet and watery grape cannot support any derangement in its fermentation, but in the southern climates this phenomenon is scarcely ever observed: it necessarily takes several days to fill a vat that contains from fifty *muids* to ninety *veltes*, yet very good wine is made in this vast vessel.

Before the must is carried to the vat it must be carefully cleansed: it is then left to undergo the vinous fermentation, and, according to M. Chaptal, is manifestly influenced by various causes, which I shall now successively examine.

Of the Influence of the Temperature on the Vinous Fermentation.

A temperature of 12°+0, of Reaumur, appears to be the most proper for the vinous fermentation. It languishes below this degree, and is too violent when above it.

It is not only the temperature of the place in which the fermentation is made that has a sensible influence upon it; the Abbé Rozier has proved, that the temperature of the grape at the time of the vintage influences it so much, that the operation is slow in proportion to the low temperature of the fruit when it was gathered. This phenomenon was observed at Montpellier last year.

The vintage not happening till the end of October, and in a cold season, the must fermented badly, and the wine it produced was poor, and very tart when taken out of the vat. This wine could only be divested of these bad qualities by undergoing another fermentation in the casks, which lasted several months.

A singular circumstance that M. Chaptal states is, the difficulty of establishing the temperature of the must when too low for fermentation, so as to effect the operation regularly. I diluted, says he, some of the must in water at four degrees of heat (Reaumur) above the freezing point. I put some yeast into it, to assist the fermentation, which commenced in a reasonable time, when

when the temperature rose to 16 degrees; but it soon ceased. A similar quantity of the must, diluted and heated to 16 degrees for two days before the yeast was added to it, underwent a more regular and complete fermentation.

On the Influence of the Air in the Vinous Fermentation.

In order that the process of fermentation may proceed regularly and expeditiously, there must be a free communication between the fermenting mass and the air. Ought we to conclude from this fact, that the air enters as a principle into the product of this operation, or as an element of decomposition? M. Chaptal's experiments refute these consequences, for he has never perceived the air absorbed in the vinous fermentation. Its influence is limited to the facilitating the disengagement of the carbonic acid gas, which would diminish the action, and finally put a stop to the operation.

The free contact of the air, which is useful in this respect, has, however, the disadvantage of occasioning a great waste of aroma and alcohol. It is also discovered that wine fermented in vessels nearly closed is often the strongest, and the most agreeable to the taste. To obtain this advantage without entirely interrupting the communication with the air, M. Chaptal recommends covering the vat with planks, on which may be extended coverlids, composed of old cloths: an excellent method, which costs little, and may be easily practised.

The waste of alcohol in the vinous fermentation is proved by the experiments of Dom Gentil, and by M. Chaptal's happy application of it to the fabrication of vinegar. Perhaps too, it is also proved by the two following facts. The white grapes found whole by M. Coste,

Coste, in the head of the vat, at the time the liquor was taken out, had the taste of grapes preserved in brandy. I have met with similar grapes, which had their whole surface bristled over with small crystals of acidulated tartrite of potash. Do these phenomena indicate that the grapes had absorbed a portion of the alcohol that escaped during the fermentation, which would have deprived them of a certain quantity of water of vegetation? I can hardly suppose it.

III. *On the Influence of the Bulk of the fermenting Mass on the Vinous Fermentation.*

It is certain that the activity of the vinous fermentation is proportioned to the mass. M. Chaptal has seen must put into a cask that did not terminate its fermentation till the eleventh day; whilst a vat filled with the same must, but which contained twelve times the quantity, had finished on the fourth day. The heat in the cask did not rise to above seventeen degrees; but it reached twenty-five in the vat.

It may be imagined that the wine in the cask could not be so good as that in the vat, where the decomposition of the principles of the must had been more perfect. However, a large vat is subject to this disadvantage, that as it acquires a stronger heat, the volatilisation of the alcohol and aroma which form the chief virtue of the wine, is in greater proportion.

IV. *On the Influense of the Constituent Principles of the Must on the Vinous Fermentation.*

Water, sugar, and leaven, are the principles of the must that have a marked influence on the fermentation. A too large or too small a quantity of any one of

of these principles is equally injurious to the operation.

The must when charged with too little water undergoes an incomplete fermentation, because the first portions of alcohol that are produced, being highly concentrated, preserve the undecomposed sugar from the action of the ferment; whence proceeds a sweet and syruppy wine, like the Spanish wines. This is remedied by the addition of water, which instantly restores the vinous fermentation.

Must that is too watery ferments with difficulty, because the fermentable materials are too much diluted. In this case the wine produced is weak and pale.

The best remedy for this fault is the addition of must, evaporated to eighteen or twenty degrees of the hydrometer of Beaumé. M. Chaptal justly observes, that great care must be taken not to thicken it to the consistence of extract, for then it coagulates the yeast, and takes from it the property of advancing the fermentation. It may be added to the liquor in the vat until this liquid acquires the usual consistence, which is between the eighth and fifteenth degrees of the same instrument.

Experiments which are always successful have proved the utility of this method.

It has, however, the disadvantage, that the precipitation of the tartar is more rapid, and that, by a natural consequence, the colour of the wine is changed. At least this has been observed to be the consequence in Languedoc. The wine merchants call it a *false* colour.

I think this effect must be attributed to a precipitation of tartar, which cannot remain dissolved in the must, and of which the first crystals that are formed attract others from the general liquid by a molecular affinity.

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This precipitation being admitted, it is easy to i gine that the tartar in precipitating carries with it colouring matter on which it acts as a mordant.

Sugar being by itself very proper for preserving o substances, its excess in the must would cause the mentation to be slow and imperfect, and necessaril furnish a wine containing much undecomposed suga

In this case yeast should be added to the must order to restore the proper proportions between the gar and the ferment.

The addition of tartar in a small quantity, as, instance, half a pound to an hundred pounds of m and facilitating the solution by boiling, is advised b Chaptal, who regards the tartar as promoting the mentation, and rendering the decomposition of the s more complete.

Too little sugar prevents a brisk and regular ferr tation, and leaves a flat wine. This fault is obvi by the help of mead, or honey; and still better by addition of molasses or sugar, of which the propor added should be from five to ten parts to a hundr must, if this method should ever be admitted amor in actual practice.

This addition is particularly indispensable whe ferment is in excess in the must, which happens i cold countries in damp grounds, where they make a weak and sour wine, very susceptible of decom tion, on account of the superabundance of the ferm able principle. This principle, on the contrary sometimes imperfect in consequence of the juic certain grapes being too sweet, and then it is nece to recur to the means directed when there is an e of sugar.

On the Progress of the Vinous Fermentation.

After having considered the various causes that influence the vinous fermentation, M. Chaptal rapidly traces the course that it takes. He speaks of the intestine motion which occasions that crust, that is called the *Chapeau de la Vendange*; he mentions the heat and the disengagement of carbonic acid gas; and he indicates what are the results of this operation. I shall notice such of these results as are most remarkable.

I. *Of the Disengagement of carbonic acid-gas.*

The production of carbonic acid gas takes place in the vinous fermentation by the re-action of the principles of the sugar already changed by the leaven; a re-action in which is effected an abstraction of carbone and oxygen. The gas that results from it is dissolved at first in the liquid, but in proportion as its formation continues it manifests an effervescence produced by the disengagement of this gas, which soon disperses in the atmosphere, and renders it mephitic if the precautions indicated by M. Chaptal are not employed.

If, whilst the wine is still fermenting, it is put into bottles, and very strongly stopped, the fermentation continues, and the gas produced dissolves gradually in the wine until it is saturated; then the fermentation is stopped by the pressure of the gas that remains free in the empty part of the bottle; and the wine that results is very sprightly and gaseous. They produce no other in Champagne; but it is customary there to decant the wine several times, in order to separate it from the deposit that forms. In Languedoc they render gaseous the very syruppy white wines that have not been vatted, by putting a few grains of wheat into the bottles.

These grains undoubtedly contain leaven, which, exciting a new fermentation, produces carbonic acid gas.

But, as M. Chaptal remarks, it is not only to the presence of carbonic acid gas that the gaseous wine owes its good qualities; it also owes them to the aroma, and to the portion of alcohol which the carbonic acid that is disengaged holds in solution. The ingenious idea of making vinegar with this gas, taken from above the *Chapeau de la Vendange*, proves this dissolution of alcohol, which is also confirmed by M. de Humboldt. Finally, the impression which this esteemed wine makes on our organs of sense leaves no doubt of its containing something more than carbonic acid gas; thus it has never been well imitated by the simple condensation of this gaseous body.

II. *On the Formation of Alcohol.*

In proportion as the sugar of the must, altered by the ferment, loses its carbone and oxygen to give carbonic acid gas, it also loses a little of its hydrogen, which, combined with the nascent oxygen of the sugar, forms water. The continuance of these attractions changes the sugar into that particular product called alcohol.

The quantity of alcohol produced is always in proportion to the quantity of sugar decomposed. The result is, an intoxicating liquor called wine, in which is found alcohol, water, mucilage, tartar, and colouring matter, &c.

M. Chaptal places the source of this colouring matter in the skin of the grape; and considering it analogous to resin, he observes that it does not dissolve by the fermentation of must until the alcohol is developed.

It is incontrovertible, that the colour of wine is always influenced by the quantity of alcohol produced.

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But I do not know that we must conclude from this fact that the colouring of the wine is entirely owing to the dissolving action of the alcohol produced. Our author announces a colour which is almost as black as ink in the very weak wines made on the banks of the *Cher* and *Loire*. It is not uncommon at Montpelier to eat very ripe grapes, the juice of which is of a strong red colour. In this country we have seen, in 1809, the must already coloured at the moment of treading the grapes, yet the wine produced from it was less deeply coloured and less spirituous than usual.

These positive facts appear to contradict the exclusive colouring power ascribed to the alcohol, by acting on the skin of the grape.

Of the Means of governing the Vinous Fermentation, and of the proper Time and Method of drawing the Wine out of the Vats.

M. Chaptal devotes two articles to the above subjects; and he shews in the first, the manner in which the wine-master should remedy the deficiency of temperature, and the too great or too small quantity of some of the principles of the must. As I have already treated on this subject, it is unnecessary to return to it.

In the second article he affirms, that the moment of the disappearance of the sugary taste, and the developement of the vinous, is the proper time for taking the wine out of the vat.

Of the Acetous Fermentation.

This fermentation differs from the preceding inasmuch as the product is constantly acetic acid. The extreme facility with which a number of bodies furnish this acid, with slight alterations, renders the processes for

 making

making vinegar very numerous; but that the result may be successful it is necessary that the acetous fermentation should take place under favourable circumstances. M. Chaptal describes six, which appear to me to be reducible to the following.

I. *The Presence of Alcohol, or of Materials that produce it.*

All alcoholic liquors are susceptible of the acid fermentation. The more alcohol these liquors contain the more acetic acid they give. It must be observed, that the pure spirit of wine does not change into vinegar: besides the fermentable vegetable matter, of which I shall speak below, this liquid requires also to be weakened with water, without which it will only produce a little very strong vinegar. And as the vinegar in this state of concentration can dissolve the alcohol, it seizes the existing portion, and prevents it from acidifying. This happens when the best vinegar is obtained from the best wine. There then remains some alcohol associated with this acid, and it is that which gives to good natural vinegar its agreeable odour.

II. *The Presence of a fermentable vegetable Matter.*

The necessity of this matter in the acetous fermentation is evident; and it is well known that wine which is destitute of it will not turn sour; the makers of vinegar also reject that which is glutinous. It is likewise well known that wine sours with little trouble when the lees are agitated, and when we mix with it tartar, gluten, ferment, and other vegetable matters that act like yeast.

III. *Of the Contact of the Air.*

All chemists agree in considering air to be indispensable to the acid fermentation; they even cite accurate experiments

experiments in support of the proposition. Yet Becher says, he has made vinegar in closed vessels; and M. Vauquelin has also made it, by leaving in a full flaggon, carefully stopped, a solution of sugar in which gluten had been diluted.

IV. *Of a Temperature from* 18 *to* 22°+0.

Wine will sour at a lower temperature; but then the fermentation is weak, and does not proceed with the same regularity as when the atmosphere arrives at this temperature.

In converting wine into vinegar the alcohol entirely disappears, unless, as M. Chaptal observes, the acetification is incomplete. But it is a question, whether the alcohol be the only principle of wine that changes into vinegar; it has been said that the other materials of wine contribute also to the formation of this acid; and supposing this to be true, it will not remain less certain, that it is chiefly by its alcohol that wine is changed into vinegar. The chemical changes that this body undergoes in the course of this conversion are what we must seek for. We might explain this phenomenon in relation to the action of the vegetable fermentable matter by attributing it to the air. In the first case, M. Vauquelin supposes that this matter takes from the alcohol, carbone and hydrogen, to make ammonia and an oily matter, which leave an alcohol more oxygenated, and which is the vinegar. In the second case M. Thenard conceives that the atmospheric oxygen makes the same abstractions from the alcohol, whence are formed water and carbonic acid gas.

In each hypothesis the acidification of the wine is caused by the extraction of a certain quantity of hydrogen and carbone from the alcohol, which renders its oxygen

oxygen predominant in the other principles of the acetic acid produced. The excess of this oxygen is not very great, since the analysis of this acid, by the super-oxygenated muriate of potash, gave to Messrs. Gay Lussac and Thenard but ·2,865 of oxygen at the most.

This analysis evidently shews, that the alcohol requires very little oxygen to change it into vinegar, as also that vinegar is the least oxygenated of all the vegetable acids; an idea very different from that which made of this product the last term of vegetable oxygenation. Finally, this analysis shews, by how many different methods vinegar may be made with little trouble.

In the number of these methods M. Chaptal carefully describes those that are employed in making vinegar from wine and beer.

The following is M. Chaptal's account of the method used at Ghent for making vinegar from malt liquor.

1,440 pounds of malt.
540 ——— wheat.
390 ——— buck wheat.

2,370 pounds.

These grains are ground, mixed, and thrown into the boiler; twenty-seven casks of river water are added; the whole is permitted to boil for three hours, and yields eighteen casks of good beer, which is drawn off. Then, on the same grains are poured eight more casks of water, which boil for sixteen or eighteen hours, when this is also drawn off. This second operation furnishes what is called small beer.

The fermentation proceeds according to the known processes for making beer, only with the difference that no hops are used.

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The malt liquor thus prepared at the brewer's is conveyed to the vinegar-maker, who distributes it into vessels that contain nearly three casks. They employ for this purpose no other casks than those that have contained Spanish wines or brandy. These barrels or pipes are laid beside each other upon tressels, that raise them about a foot from the ground. They are placed in a very open situation, that nothing may intercept or weaken the rays of the sun; and a hole, six or eight inches square, is made in the upper side of the casks.

Some vinegar-makers leave the strong and small beer to ferment separately, and obtain vinegar of two qualities, which they afterwards mix; others mix the strong and small beer together previous to the fermentation; but it is indifferent which method is followed.

The barrels are only filled to within half a foot of the opening at the top. This precaution is necessary, that the strong beer may not run over during the fermentation. The barrels remain always open, and tiles are put over the hole at night, and in rainy weather.

It is usually towards the end of May that they begin to make the vinegar, and it is completed in about four or five months. Towards the end of September they rack it for sale.

Each cask of beer contains one hundred and forty pots (Ghent measure), which yield only one hundred and twenty pots of vinegar: thus the whole brewing produces only two thousand eight hundred and eighty pots of vinegar.

In order to understand these quantities, it is necessary to observe, that the pound at Ghent and the pound at Paris are as 13 to 10; and that twenty-three pots Ghent measure equal ten Paris pints.

List

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List of Patents for Inventions, &c.

(Continued from Page 191.)

GEORGE GILPIN, of Sheffield, in the county of Y Worsted-spinner; for a machine or instrument for co ing wool and preparing it for spinning, and also dressing flax and preparing it for spinning; and certain improvements in the construction of a mach known by the name of a Breaking-Frame, for dri and clearing of the wool from the combs used in first-mentioned machine, and also a stove to be he by fire or steam for the purpose of heating the combs. Dated June 11, 1811.

JOSEPH TAITE, of Bermondsey New Road, in county of Surrey, Gentleman, Bryan Donkin, of B mondsey, Engineer, and William Dixon, of Bermo sey aforesaid, Millwright; for machinery for finis piece goods or other flexible articles or materials of like description, by glazing, burnishing, graining making impressions upon the surfaces thereof res tively, as may be required. Dated June 11, 1811.

WILLIAM PIPER, of Woolverley, in the county of W cester, Iron-manufacturer; for an improved mod manufacturing gun skelps. Dated June 11, 1811.

RICHARD WATERS, of Fore-street, Lambeth, in county of Surrey, Potter; for a method of manufac ing pottery ware. Dated June 14, 1811.

ERRATUM.

In our last Number, page 188, line 15, the words *and effect* to be expun

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THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXIII. SECOND SERIES. Oct. 1811.

Specification of the Patent granted to JOSEPH C. DYER, *of Boston, State of Massachusetts, one of the United States, now residing in Gray's Inn, London, Merchant; for certain Improvements in the Construction and Method of using Plates and Presses, and for combining various Species of Work in the same Plate, for the Kind of Printing usually called Copper Plate Printing, designed for the Objects of detecting Counterfeits, for multiplying Impression, and saving Labour. Communicated to him by a Foreigner residing abroad.* Dated October 1, 1810.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Joseph C. Dyer do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: First. Whereas engraved plates of copper are, from the nature of that material, speedily worn out, and cannot be accurately and precisely restored to their original state,

and do require great skill and expenses to retouch them, I do construct and use a plate or plates made of steel, either throughout or (by preference) only as to the face thereof. And I do make the said plate or plates much thicker than ordinary, to the intent that the same may not be liable to spring, bend, or be injured, by the act of hardening (hereafter described); and in order also that they may not be subject to break or get injured whilst receiving the necessary degree of pressure in using or printing with them. And the said plates may also, if convenient or requisite, be made and fashioned, and engraved of iron of the most uniform texture, or of steel decarbonated or converted into iron. And after the workmanship of any of the said plates shall have been completed, I do then convert the same, or the surface thereof into steel, by the method called cementation, or case-hardening, and I do then render them hard by immersion, when red-hot, into water. And I do farther declare, that the purposes aforesaid may be effected by the various well-known means of decarbonating steel, and cementation or case-hardening; but that in preference to any other method I do use the following, namely, I make my plates of cast-steel, properly shaped, and I do then decarbonate or convert the same, either partially or wholly, into iron, by putting the steel plate or plates into a box or case capable of being closed and luted, and of sustaining heat; a cast-iron box will answer very well. The steel is surrounded in the box with oxyd of iron, or rusty iron filings, from half an inch to an inch thick on every side, and in this state the closed box is kept red-hot for not less than three nor exceeding twelve days, according to the thickness of the plate, and the depth to which the decar-

bonating process is intended to be carried. In general nine days answers very well for common sized plates, which are about five-eighths of an inch thick. And again, to convert the iron into steel, after it shall have been engraved, etched, indented, or otherwise wrought with the various species of work as desired, I do put the same into the box, as before, and surround it on all sides with a powder, made of equal parts of burned bones and the cinders of burned animal matter, such as old shoes or leather, and in this state I expose the box with its contents closely luted and secured from air, to a blood-red heat for three hours, after which I take it out, and plunge it perpendicularly edgewise into cold water, (which shall have been previously boiled, to throw off the air that it may contain,) in which I gradually and slowly lower it to the depth of three or four feet, and leave it at that depth until cold; by this means the plate becomes hardened, without danger of springing or cracking. And in order to make the same more tough and tenacious, I brighten the under side of the plate with an oil stone, and then heat the plate until this brightened part acquires a pale straw colour. And, lastly, I cool the plate in water, and polish the surface ready for use.

The above process of tempering or letting down must be carefully done, according to the precautions well known to workmen in steel, such as applying the heat from a larger and thicker mass of cast-iron than the plate itself, or from melted lead, or (which is best of all) from a bath of oil, heated to the temperature of 460 degrees (or thereabouts) of Fahrenheit's scale. Plates thus constructed are what I call *Perkins's Steriographic Steel Plates*, one of which will serve to give as many

 impressions

impressions as would wear out a great number of copper plates; and from the use of these thick plates (whether they are constructed of steel as aforesaid, or of any other metal) another considerable advantage is derived, namely, for the printing of bank notes, bills of exchange, lottery tickets, or any other prints or documents wherein a part or parts of the impressions from the plate or plates may be required to be changed from time to time, the same is effected by means of any number of moveable blocks or pieces fitted in the said plates, so as to form a part thereof, and having engraved, or otherwise wrought thereon, the said parts or portions of the impressions, which are or may be required to be changed; and in constructing my said plates for this purpose I cause holes or mortices to be made through them in such place or places, and of such sizes and figures, as the part or portions of the impressions required to be changed may determine. And in these mortices I place the said blocks or removeable pieces, (after they shall have been made, engraved, or wrought, as aforesaid, and which may be of steel or other metal,) and accurately fit and secure them therein, so that their engraved, or otherwise wrought surfaces or faces shall be evenly disposed, and form a plane with the face of the plate. These moveable blocks are particularly calculated to contain the names of places whence the notes, documents, &c. are issued of banking and other companies; the denomination or amount of the dates, numbers, &c. &c.; in all of which cases they will serve instead of new plates, which it would otherwise be necessary to have. And such removeable parts of the plates will likewise be found useful in all cases where it may be desirable to make frequent alterations

tions in the figure, or general appearance of the said notes, documents, &c. which will have a tendency to discourage counterfeiting of them.

Secondly. In order to render the counterfeiting of bank notes and other printed documents more difficult, or physically impossible to be done with precision, I do construct and use a compound plate, called a check plate, the impression from which being taken upon the back or other part of the surfaces of such notes and documents, will afford various corresponding gage-lines for examining the same. And I do form the said check-plate, by placing any number of pieces of steel (decarbonated as aforesaid) alongside of each other, and so fitted together by the adaptation of plain or other surfaces of contact, and of such dimensions as to constitute one plate, which I do fix in a frame, by keys or otherwise. And upon the said plate I do engrave, etch, impress, or otherwise mark, or make a variety of lines, strokes, letters, flourishes, or irregular chance work, such as may be extremely difficult to be imitated without great expense, or altogether impossible to any considerable degree of precision. And then I do separate the said pieces, and reconvert their surfaces into steel, and harden and finish as aforesaid. And in recomposing or putting together the said compound plate, I do interpose between each engraved piece another corresponding piece or slip of cast-steel, which may be polished, or have any uniform or other ground upon the surface thereof. And I do then securely fix all the said pieces so alternating with each other in a case or frame, and the same do then compose and constitute what I call *Perkins's Check-plate*, and will afford an impression consisting of certain stripes of engraving alternating with other

other stripes of plain paper, or paper having thereon an uniform or other ground, as aforesaid. And I do declare, that with regard to the use and application of the said check-plates for detecting counterfeits, I do not only examine and compare the suspected note, document, or print, with another note, document, or print, which is or shall be known to be authentic, and truly made or printed from the original check-plate supposed to have been counterfeited; but I do also fold back a part of one of the said two notes, document, or prints, at one of the lines of contact of the said plates, or elsewhere, and do apply the folded edge upon and against a line of the other note, document, or print, which should or ought to correspond with the first-mentioned line at which the said fold shall have been made; and in the event of the most accurate, precise, and determinate correspondence and agreement of the lines, strokes, letters, flourishes, or irregular chance work, being found to take place in both the said notes, documents, or print, I do pronounce the same to be both authentic and true; but if otherwise, I do infer and declare the suspected note, document, or print, to be counterfeit.

And, thirdly, for the same purpose of rendering the counterfeiting such notes or documents as aforesaid more difficult to be effected, I do avail myself of the process of engraving, or otherwise marking or making various lines, strokes, letters, flourishes, or irregular chance work, as aforesaid, upon blocks, or pieces of steel fixed together, so as to form one plain surface, as hereinbefore described; and of afterwards separating the same, in order to form the parts of a print, or impression, so capable of checking with each other. And I do make and use the said parts as punches, or impressing instruments,

for

for making the like lines, strokes, letters, flourishes, or irregular chance work, in a reversed manner, upon various parts of the face of another plate intended to be used for printing. And I do separate the said parts to be used as punches or impressing instruments from each other when completed, and do securely fix the same at regular or irregular distances from each other in a frame, or mortised or perforated piece of metal, so that the engraved faces thereof shall stand evenly in one plane, a little elevated above the face of the said piece of metal, and be capable of being used all at the same time for making or impressing the said reverse engraving upon the last-mentioned plate by the application of a suitable blow or regulated pressure.

Fourthly. As to the method or methods of making the engravings, marks, or designs aforesaid, upon the said plate or plates, I do use all the well-known methods of engraving, properly so called, which consists in the mechanical use of various tools, and of etching, which consists in a great measure in the chemical use of aquafortis, or some other corrosive fluid or material, through the interstices of a ground. And I do also produce imitations of block work, and multiply the same engravings upon metallic plates by means of hard steel cylinders, which I call *indenting cylinders*, having marks, impressions, or engravings, upon the circular face thereof, which I do transfer to the face of the plate itself, by causing the said cylinders to revolve on, and move backwards and forwards, over the surface of the plate under a powerful pressure, by which means the figures, letters, and block-work on the cylinders, will be indented or impressed upon the plate. And although the preference is undoubtedly to be given to the steel

plates,

plates, constructed and made as aforesaid, for printing in all cases where durability and the other desirable qualities hereinbefore mentioned or alluded to are or may be required, I do nevertheless, whensoever the same may be requisite or desirable for carrying the said invention, or any part thereof, into effect, make use of copper, or any other fit metal, for making plates for effecting impressions from designs or engravings as aforesaid.

Fifthly. With regard to the method of using plates and presses in the annexed designs, Fig. 1 (Plate XIV.) exhibits an improvement in the table or board, C C, of the common press, Fig. 4, in which P denotes a cell, containing a cast-iron or metallic box, for the purpose of placing therein a heater, represented by the part opposite the same letter in Fig. 4. The dotted space, Fig. 1, denotes a perforated plate laid in a groove in the rim of the said box above the heater, and upon this last the engraved plate is placed, and may be kept at a proper temperature, for a considerable time, without changing the heater or removing the plate, which obviates the inconveniency that would otherwise attach to the use of the thick and heavy steel plates aforesaid.

Fig. 2 represents a cylindrical inker, which I use instead of a common dauber, (or rubber as they are called,) consisting of a sufficient number of circular pieces of cloth or felt, accurately of the same size, which are put upon an axis, and confined together with a cylindrical piece at each end, closed against them by being screwed upon the axis, or by any other fit method.

Fig. 3 represents this inker not completely made up. The ends of the axis are continued beyond the pieces

which

which confine the cloth, so as to afford handles, by which the same may be rolled upon the ink-block, and upon the plate, whereby the friction occasioned by the striking and rubbing of the old inker is prevented, and a great saving in the wear of plates produced. And in order that these opperations may more easily be performed, the said handles are included within cases of tin, or other fit material, which allow the said handles to turn freely therein in the use of this inker, of which (the faces when compleat form an entire cylinder) the same is to be rolled first upon the block or table containing ink, and when duly filled, then upon the engraved, or otherwise wrought, printing plate; which last is to be wiped and cleaned of the redundant ink as usual.

Fig. 4 a copper plate-press, of the usual form, having the pressing cylinder *d* reduced at one side, in the well-known form called the roller, (chiefly used by calico-printers,) for the purpose of allowing the table and cushion to return by means of counter weights after the impression shall have been taken; and when small plates are used the reduced portions of the surface may be more in number than one. In the use of this press (to which I claim no exclusive privilege excepting as to the improvements of the press-table, hereinto before described) the pressing roller is constantly turned the same way, and as the plate does not require to be taken out for heating, the saving of time and labour is very considerable.

Fig. 5 affords a front view of the same press, with the blankets or cushions up, and the press-table brought forward by the counter weights.

Fig. 6 represents the form in which I usually make my aforesaid indenting cylinders, (as being the most convenient to be used), but this form may be varied according to circumstances, the long end of its axis (with the winch thereon) should always extend beyond the edge of the plate to be indented so as to allow the winch to turn freely, and cause the said cylinder to revolve and move over the surface of the said plate. In using the indenting cylinders, I adopt a long foot lever with two branches, which are made to press on the axis of the said cylinders, on each side of the indenting surface thereof; and (extending in a parallel direction over the plate) the said branches are made smooth, so as to allow the said cylinder to revolve, and move laterally under them with such degree of pressure as the nature of the work to be impressed, and the density of the plates may require. And although I find this the most convenient method of performing this indenting process, yet any other method by which the cylinder may be made to revolve on the plates, under a suitable pressure, will answer, and may be left to the judgment of the workman. The indenting cylinders I generally make about one quarter of an inch thick, and two inches in diameter at their indenting surface, but the size and proportion thereof may be considerably varied, without prejudice to their performance. The indenting and inking cylinders are drawn on a larger scale than the other figures.

The invention here described, with the numerous valuable improvements arising from, and connected with it, are the result of many years labour, perseverance, and study, which have been devoted thereto by Mr. Jacob

PLATE XIV, VOL. XIX, SECOND SERIES.

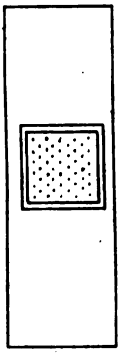
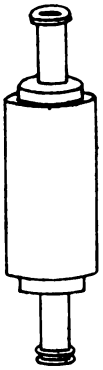


Fig 1.



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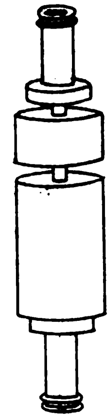

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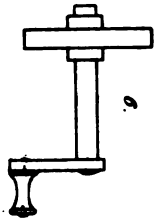

6.

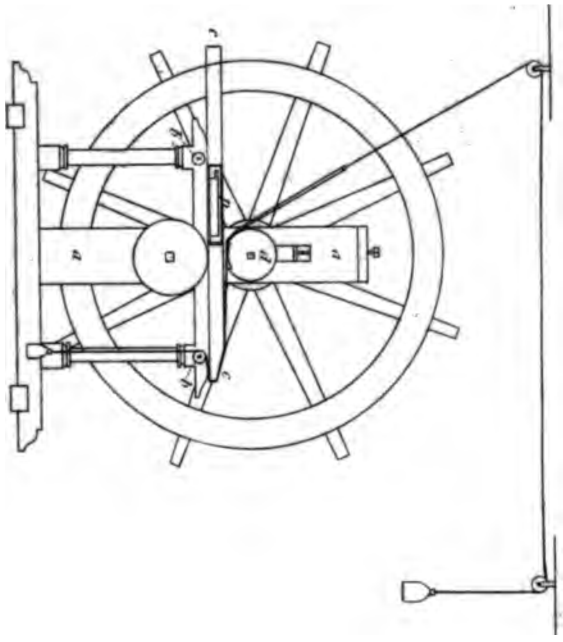

Fig 4.

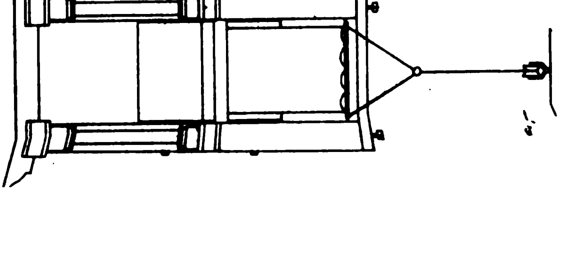

Fig 5.

Jacob Perkins (the inventor thereof), a gentleman well known in New England as a learned and very superior artist, and author of many new and important inventions for the advancement of the arts and manufactures of that country.

The above improvement will (I have no doubt) be found of great importance in this country, as adding to the stock of knowledge in that branch of the arts to which they relate, and especially as affording the most effectual means hitherto discovered for preventing and detecting counterfeits. This supposition is warranted from the experiments already made in America; as this method for preventing and detecting counterfeits has not only gained Mr. Perkins much esteem and celebrity in that country, but by the adoption thereof in the printing of bank notes the circulation of counterfeits (which had become a great evil there) is entirely prevented. And the legislature of Massachusetts (his native state), sensible of the eminent advantages to the republic derived therefrom, have passed a law to sanction the adoption of this invention by the banks there, and to patronise the ingenious author.

In witness whereof, &c.

[redacted]

Specification of the Patent granted to James Hall, *of Walthamstow, in the County of Essex, Clerk; for a Method or Process of manufacturing a Material from the Twigs or Branches of Broom, Mallows, and Rushes, and other Shrubs or Plants of the like Species, to be used in the Stead of Flax or Hemp, and for the same Purposes for which Flax and Hemp are now used.*

Dated July 3, 1810.

With an Engraving.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said James Hall do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows; that is to say: The twigs or shoots of broom, of the former years growth, and the most vigorous, are always the best and useful, only for the flax of broom, they being surrounded with a double covering, the outer resembling scales, or the husks of wheat, rye, and the like, and the inner a substance of the nature of flax. The shoots or twigs of broom that are more than a year old have also two coverings, but the scales are much thicker, and the flax is so intermixed with gum, oil, and other materials of the kind, that a bark is formed in which the flax is so embodied that it refuses to be separated. The representation of the shoots or twigs of broom, as appears in the margin of these presents, explains what ought to be taken and what left, all above the double line B, (Fig. 1, Plate XVI.) in the twig *b b*, being proper, and the rest not, and all above the double line *a*, in the twig *a a*, being

ing proper, and all below not. The small twigs are scarcely of any use, and used not to be cut, or if cut with the rest, to save the trouble of choosing and cutting every individual shoot or twig by itself, they should be left, as not worth the pains. Those, therefore, who cut broom for the sake of the flax should, with a crooked instrument like a reaper's hook, but with a longer handle, to save the trouble of stooping much, cut above the double lines *a* and *b*, but never below them. The shoots or twigs may be collected or not immediately when cut; and if they lie a month or two about the bushes from whence they have been cut they will scarcely receive any injury. With regard to their roots and branches, they should as much as possible be laid all one way, and be tied up in parcels with bands of broom, in the same way as is done with wheat, flax, hemp, &c. On being steeped three or four weeks, according to the heat of the season, in stagnant water, or boiled an hour or two in water, the flax comes easily from the shoots or twigs, and, where there is not machinery for the purpose, may be peeled or stripped off by children, or others, at any time when not quite dry, in the same way as hemp is peeled from the stalks. The shoots or twigs may be cut down at any time from the latter end of September, when the growth ceases, till April or May, that a new set of shoots are forming; but unless the process is carried on by boiling the broom, the best season for steeping the twigs or shoots, as also for preparing the flax for the manufacturer, is during warm weather, as the hands are often wet during the process, which is unpleasant, and by no means wholesome, either for old or young during cold weather. If water cannot be conveniently had for steeping them, the

twigs

twigs or shoots, as already noticed, do not lose any of their value, though kept for years, if kept dry. These, on being spread out to the dew or rain, or any wet, and then heaped together, soon begin to ferment or heat; and after this heating or fermentation commences, which must not be permitted to proceed too far, for fear of rotting it, the flax comes easily from the twigs or shoots, in the same way as if it had been steeped in water. If the twigs or shoots are suffered to ferment or heat too much, the flax being thereby damaged, breaks in stripping off; but if they are not fermented enough the flax adheres, and does not come easily from the twigs. The same is the case when they are steeped or boiled in water; if too little done the flax does not come off easily, but breaks; if too much, it does the same; but the breaking arises from the flax being hurt by over-much boiling or steeping; those, therefore, who are employed in this business have only to take a twig or stalk out now and then, and see when the whole is ready, by trying a few individual shoots. Where broom has been steeped the water becomes partly fœtid, or stinking, and of a darkish colour, and it acquires such a taste as makes cattle dislike to drink it; but neither the taste nor the smell is so disagreeable as that produced by the steeping of flax or hemp. Broom swims when first put into the water, but soon begins to sink, and to have a peculiar, though not an unwholesome smell: this smell gradually disappears both from the flax and the twigs denuded of the flax as they become more dry. When the flax is stripped from the twigs or shoots it appears dark, gummy, and seemingly of no use; but on being washed well in cold water, then rubbed and shaken, which may be done by machinery or hand-labour, the flax begins to appear,

appear, becoming more and more strong, and pleasing to the eye, as it dries, and is cleared of the scales or chaff by being rubbed and shaken. If the broom-flax is to be hackled, which in general should be left to the manufacturer, the hackle, particularly the first one, should be like a comb, having only one row of teeth, as from its nature and the fibres of which it consists not proceeding in straight lines but from a variety of smaller, branching out from the main stem or shoot, broom-flax does not bear the hackle well, either wet or dry. On being simply washed, rubbed, or shaken well, broom-flax becomes an object of much importance to a variety of people, as well as to the paper manufacturer, the manufacturer of patent floor-cloth, also the manufacturer of rugs, carpets, and other useful purposes. The shoots or twigs of broom, on being cleared of the flax, boiled a given time, or steeped in boiling water, become tough, and beautifully white, and admirably calculated for being converted, under the name of Genesta-wood, the generic term for broom of all kinds, into carpet brooms, brushes for furniture, cloths, green cloths, and rincers for cooks, charwomen, and the like, at the same time into various useful purposes, where things are dusty in the dressing-room, coach-house, &c. as well as for certain parts of all kinds of wicker-work. In procuring the flax of rushes, which so far as is yet discovered is not an easy matter, the rushes are to be exposed for months in water; on other occasions they are either to be buried in a stable dunghill, and heaped together to heat or ferment, or to be plunged into some cheap chemical menstruum or liquid, so as to separate the flax, of which all kinds of them contain a considerable

able quantity, from the green outer coat, to which it adheres very tenaciously.

When a material for certain kinds of paper is the object in view, the rushes are to be beat to a pulp by a mill, or otherwise, in water, either hot or cold, as convenient, and then sent through a search, or searches, as occasion may require, for the sake of the fibres and flaxen materials that do not pass through the searches.

In procuring the flax or fibres of mallows, particularly the *Malva Silvestris*, which grows in abundance in many parts of Britain and Ireland, and even in the immediate vicinity of London, without being thought worth cutting down, the mallows and plants of that nature are to be steeped three or four weeks in water, or more if necessary, or to be put into a heap to ferment, and then to be denuded of the flax or fibres by stripping or peeling them off, which is an extremely easy matter, as these are beautifully white, resembling camel's hair in many particulars. After being stripped off they require only to be washed, either in cold or warm water, shaken and hackled a little, which may be done either wet or dry, previous to their being sent off to the manufacturer of shawls, fancy vests, and fabricks of that nature, for which they seem admirably calculated.

All which I claim as new, and invented by me. And I have set forth the same particularly, in order that my invention, and the manner of using and applying the same may be completely disclosed and understood; so as to be put in practice by others when my patent expires.

In witness whereof, &c.

Specification

Specification of the Patent granted to JOHN STANCLIFFE, *of Caius College, in the University of Cambridge, and of Tooke's-court, London, Bachelor of Physic; for certain Improvements in Apparatus for Combination and Condensation of Gases and Vapours applicable to Processes of Distillation.* Dated April 6, 1810.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Stancliffe do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in the plan hereunto annexed, and the following explanation; that is to say: These improvements and apparatus for combination and condensation of gases and vapours applicable to distillation consist in the means of dispensing with ordinary modes of luting, as connected with the facility, freedom, and play of several parts of the apparatus, and especially of rotatory agitation, with comparatively little friction, by which the contents both of the still itself and refrigeratory, or refrigeratories, may be kept in constant agitation, and large surfaces of fluids may be presented to vapours or gases, to hasten condensation. The necessity of stuffing boxes, as applied to stills, (always objectionable, both from the materials of which they are formed and the friction of the axes passing through them,) is thus done away. These improvements farther consist in the means of operating with ease under considerable columnar fluid pressure; in every case, whether of simple or compound distillation, or processes analagous, without danger to the

 opera-

operators or liability to accident of the apparatus. The ordinary refrigeratory and worm-tube used by the distillers need not be employed in many instances, though the new apparatus may be used as an appendage to this part of the old process, and with advantage in most cases. The truth of these remarks must be obvious by a reference to the annexed drawing or diagram, which exhibits a general idea of the improvements alluded to.

Fig. 1, (Plate XV.) in these drawings, is a representation of the apparatus by a section through the centre of the whole; and Fig. 2 is a perspective view, to give a clearer idea of the same: the letters refer to both. A A A is the first vessel or boiler to which heat is applied by any of the means in common use, as by a lamp for small apparatus, or by fire-grate, &c. This vessel is formed of two prisms or cylinders A A and *a a*, one within the other, leaving a space between them in which the liquid luting, hereafter to be described, is situated. In this space the cylinder, or prismatic part of the head B B, is received, and its lower edge immersed in and surrounded by the said luting, so that no elastic vapour in the head B can pass beneath the bottom of it unless its pressure is such as to overcome the weight of the column of the fluid which is placed between the two cylinders *a a* and A A. By means of this luting the head B can be taken away readily to open the vessel, and when it is put down in the space between the two cylinders, the luting forms an air-tight joint, without the necessity of any part of the contents of the apparatus coming in actual contact with the liquid luting. Here I must observe, that some contrivance is necessary to keep down the head B, as the pressure of the elastic vapour acts to raise it up: this may be performed either by

[redacted]

by hooks, screws, bolts, or any other method which is best suited to the particular occasion. One I have used with success, is two, three, or more pieces of metal, projecting from the upper external edge of the cylinder *a a*, and two, three, or more corresponding pins, projecting from the inside of the cylindric part of the head B. When this is put down into the luting in a proper position these pins do not interfere with the said projecting pieces of metal; but by turning the head round when it is down in its place the pins catch under these pieces, and prevent the head rising by the action of the vapour. W is a funnel and cock by which the boiler may be filled with the matter to be operated upon. C is the tube which conveys away the elastic vapours to the refrigeratory D D, which is composed of two parts, the lower part made by two cylinders D D and *d d*, in the same manner as the boiler to receive the liquid luting, which makes a joint with the cover or hood E E, as in the former instance. The shape of the cover or hood is represented here as flat at top, but the shape is of little consequence in the process of distillation. The term hood is employed here only because the upper part of the apparatus seems to cover or to hood the lower part. In this hood are two, three, or more tubes L L M, projecting from it, which are for the purpose of connecting it with the tub C, coming from the boiler and others, as O, leading to second refrigeratories, or any other apparatus. The joining of the tubes C or O with the refrigeratory is by the same method of liquid luting as the boiler before described. F is a pipe, soldered on the top of the hood, and *f f* is another, surrounding the former. The space between these receives the tube C, to be connected with the hood, and retains the liquid

 which

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which surrounds the joining. By this means the tu can be readily disjointed, but when put together m a perfect fitting: they are held down from rising by t pins *x x*, (see Fig. 3,) projecting from the tube which, when turned round, catch beneath two hooks soldered upon the external tube *f f*, or any other m of fastening may be adopted where necessary. In centre of the refrigeratory, what is termed the agitator placed the tube M, rising from the centre of the ho being devoted to the purpose of making a fitting ro its axis in the following manner. The tube N is m to surround the axis *n* of the agitator, being fastened it at *g*, so that the tube forms a complete hood, and volves with it in the space between the tubes F and which, containing fluid lute, prevents the escape of elastic fluid from the refrigeratory. At the same ti the axis *n* can be freely turned round with but li friction by the handle *m*, or other methods, to c vey motion to the agitators fixed on the lower end of axis *n*. These agitators are two, four, or more lea or arms, as shewn in Fig. 4, and introduced at Z Fig. 1, formed of any convenient matter, and of proper figure, which, when turned round by the han *m*, sweep the whole centre of the vessel D D, so as agitate and disturb every portion of any fluid contair in it, which I have found very favourable to the co densation of vapour; or the usual methods of produci agitation, connected with any axis, may be equally plied to the axis *n*. These agitators may be made such figure as to fill up the vessel, whether the top bottom of the same is flat or globular, concave or co vex. The axis *n* of the agitator may be supported a turns round by two bearings, one at the lower end of

inter

interior of the tube M, and another at the upper end of the same. At these points of bearing it must be made cylindrical, and be received into slight collars, fixed as before mentioned, one at the top and another at the bottom of the tube, within M. Or these bearings may, if more convenient, be made at the extreme ends of the axis; in which case the lower one must be supported at the bottom of the refrigeratory, and the upper one in any convenient frame over the whole apparatus. The boiler A A may, if necessary, be adapted to receive an agitator to stir up any matter present, and prevent the same from burning. It is to be fitted with liquid lute at the junction of its axis R, by the same method as above described. Its arms S, Fig. 1, may be furnished with chains, to drag round the bottom, in the usual manner. H H, Fig. 1, represents a gutter, fixed around within the head B B, to receive any fluid which is condensed in the same, and convey it through the pipe C into the refrigeratory. At W a cock may be placed, to draw off the products from the refrigeratory, and the fluid lute may be removed, when necessary, by a syphon, or by a cock, as at Z. To prevent the apparatus growing warm, as this would destroy the effect of the refrigeratory, it may be immersed in a vessel of cold water, at the dotted lines *r r*, Fig. 1, after the usual manner. The hoods both of the boiler and refrigeratory may be adapted to be drawn up at the same time by pullies, or otherwise, where the apparatus is large, so as to remove them for clearing of the residual matter in the boiler and refrigeratory, though the drawing only exhibits one refrigerator. I propose, for the distillation of such matters as require it, to use several, through which the vapour passes successively, until it is all condensed. The tube O

is

is supposed in the drawing to lead to such second vessel; and it is plain a communication may be made with any number by the same means.

Fig. 5 shews the method by which any vapour or gas may be introduced into the refrigerator when the same is not raised in a boiler, as shewn in Fig. 1, but by any other means. It consists of a pair of bellows V, with a pipe T coming from the vessel containing the vapour. Affix the orifice of the valve to the nose of the bellows: another pipe, *t*, is fixed and connected with the refrigerator by liquid lute, in the same manner as the pipe C, Fig. 1. Now it is evident, that by working the bellows the vapour will be drawn into them through the pipe T, and expelled from them through the tube *t* into the vessel, even when the vapour has no elastic force to rise of itself and pass over.

These improvements are obviously applicable in all cases of distillation, in the rectification of various liquids, as of alcohol in the preparation of æther, and of the mineral acids, as the nitric, muriatic, oxymuriatic, and, indeed, all other volatile but condensible vapours and gases, whether acid or otherwise, separable, by processes similar to distillation; as also in separating the pyroligneous acid, and other volatile matters, from coal, and obtaining the condensible from the uncondensible portions, as the tar, oily, alkaline, and saline matters, from the carburetted hydrogen, which may be at the same time applied to known and useful purposes. The apparatus is equally applicable for impregnating liquids with carbonic acid gas as for other condensible volatile products, of whatever nature, or from whatsoever source, they may be derived.

This

[redacted]

This apparatus may be also employed with advantage in the depuration of linen, wool, woollens, cottons, &c. which may be introduced into the condenser, refrigeratory, or recipient, and there be exposed not only to agitation, but to the vapour of volatile alkali, or steam of water, thrown off by the first process of distillation, and carried into the condenser containing the agitator. The impregnation of alkaline, earthy, or metallic matters with acid, or other vapours, is readily effected by throwing these volatile acids, in the act of distillation, from the place where they are generated into the refrigeratory vessel or vessels where the condension is to be effected; and solutions of some of the gums may be promoted, as of copal, by throwing their proper solvents, in a state of vapour, from the first part of the apparatus under sufficient columnar fluid, pressure and temperature. Hence its importance, as well to the varnish maker as to others concerned in operations where the principle of distillation may be advantageously introduced. Its application in pharmacy, to obtain volatile vegetable extracts, is manifest, as well as its economical application to various domestic operations on any scale; and many operations which have been heretofore managed with difficulty, or considered as nuisances, may be effected by this apparatus with ease, and without being offensive. As, for example, the obtaining of spirits of hartshorn, animal oil, or ammonia, from bones and other animal recrements, the number or capacity of the refrigeratories being always proportioned to the quantity of volatile product to be condensed, and the depth of the liquid luting being always such as to allow the escape of a portion of the product rather than detriment the containing vessels, which ought to be in preference constructed

structed of materials which cannot re-act chemically upon either the liquid luting or product to be condensed. By having the vessels of considerable strength, it is obvious that the power of condensation, as aided by the pressure of the fluid luting, may be indefinitely increased; and that nothing is wanted for completing the condensation but the power of presenting large surfaces of the vapour or gas, by agitation, to colder medea; for which the apparatus is well adapted, as the condensers or refrigeratory vessels may be immersed in vessels containing cold water or ice, as is sometimes the practice in ordinary distillation with the worm-tube, and which water, as it becomes warm, may be constantly supplied with cold water. For the like reason it is manifest, that when the air, gas, or vapour, to be condensed, is thrown into the recipient or refrigeratories containing such agitators, by means of bellows, (whether common or hydrostatic,) retorts, or other known and obvious means, such condenser, with its appropriate agitator, is considered and claimed as part of my improvements. It may in many cases be found that the agitator is not necessary in the several condensers, and in few cases will it be required to be constantly employed. This must depend upon the facility or ease with which the vapour condenses, as connected with the quantity to be actually condensed in given times. The principle applies to apparatus on any scale. The altitude of the column of the fluid luting must in most instances be determined by the nature of the process; but where there is a probability of a rapid condensation of the volatile products and regurgigation of atmospheric air, they had better be somewhat less than half the depth of the containing tubes, by which means all possibility of mixture of the fluid

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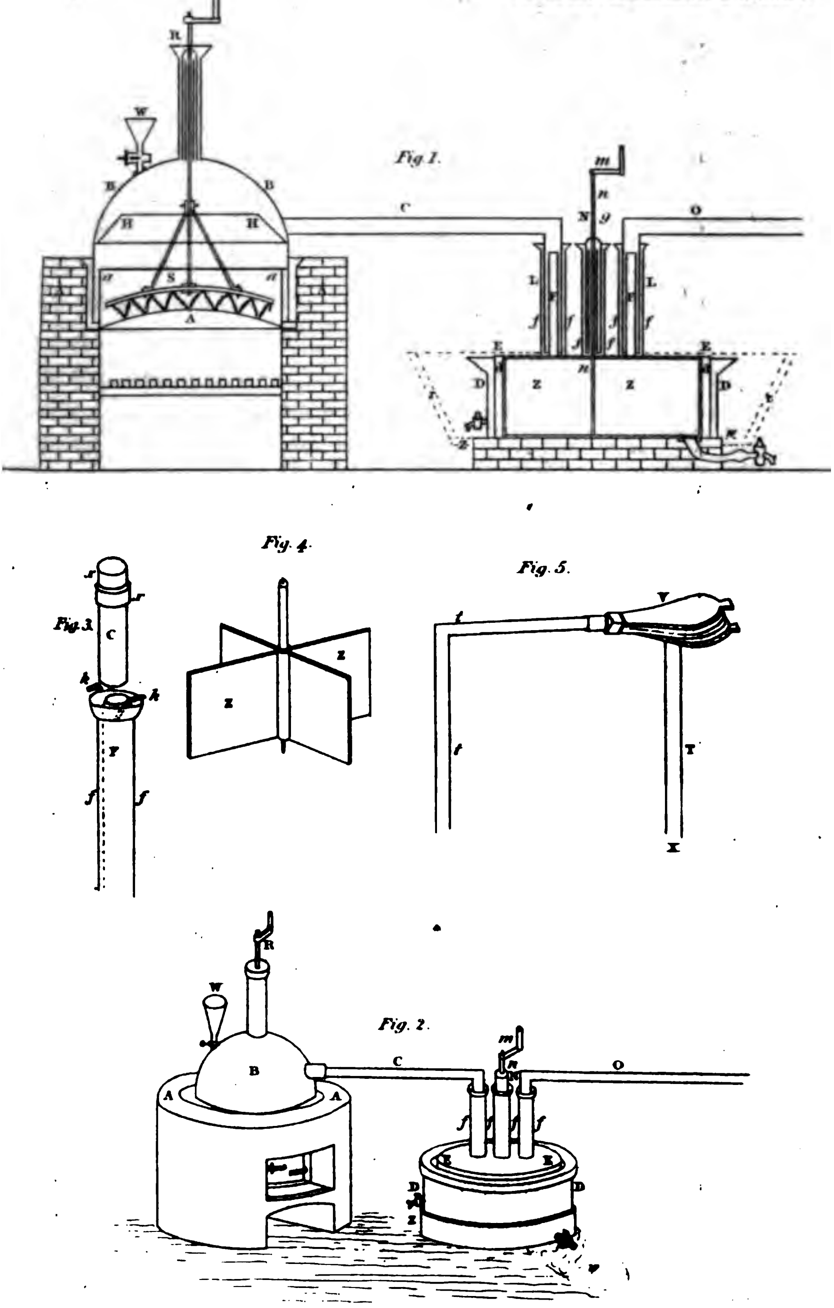
PLATE XV. VOL. XIX. SECOND SERIES.



[redacted]

fluid lute and condensed vapour is prevented. In many cases this may be of little or no consequence, as my experiments have proved. The residue may be drawn off by a cock or syphon from the different recipients when fluid; and when too thick to run in this way, may be removed by elevating the hood or head which passes into the liquid lute of the refrigeratory, or other vessels employed, as well as of any other parts, which are made similarly air-tight. From an inspection of the apparatus it is obvious that the fluid lute will rather give way than allow of accumulation of uncondensed vapour or gas to the point of explosion or rupture of the vessels. This method therefore implies the most perfect security to the operator. The width of the interstices destined to contain the fluid lute may be varied according to the speed of condensation or number of refrigeratories. The hoods may be held down by weights in some instances as well as catches and the means described. Since the forms of the vessels may be varied at the pleasure of the operator, or according to circumstances, without detriment to the principle, in other words, that their horizontal sections may be square, round, oval, oblong, prismatic, or polygonal, so may the materials of which the apparatus is constructed be varied in any instance, since all materials capable of being put into the requisite forms may be used. These may be varied with advantage, according to the circumstances. It being desirable always to have in mind, that there should be as little action as possible, chemically, excited upon the materials of which the apparatus is composed, by the reagency of their contents; and for the same reason it will be desirable to have a fluid lute, which will not be acted

 upon

upon any more than the containing vessels by the matters subjected to the process, or which are the result of distillation. It may be either water, saline solutions, mercury, fusible allays, oil, wax, tallow, or any substance capable of being liquified, provided it does not much interfere, by its chemical action, with the vessels or their contents. The structures and distribution of the agitators connected with their supports and fluid luting must obviously much diminish the friction, compared with what it would be in articles confined in stuffing boxes and the like; all commerce with external air being at the same time entirely cut off. When the apparatus is employed with a view to the condensation of the mixed gases or vapours and aëriform fluids, which are in part condensible, but some of them cannot assume the liquid state under known atmospheric temperatures, as is the case with some of the products of common coal when subjected to distillation, then the gas escaping may be collected in gazometers, after the known methods, and kindled for the purpose of yielding light and heat in contact with the atmosphere, or applied to other uses, according to the nature of the gaseous product itself. The condensing refrigeratory recipients may be also adapted to the ordinary stills and worms in use, or attached, as in the diagram annexed, to the vessels similarly constructed, and which are placed over the furnace, water-bath, or other sources of heat. It is obvious that cold water may be supplied, by an additional bath containing cold water, in proportion as the liquid lute gets warm. It is supposed, therefore, that in all cases which require it, the condensers are immersed in cold water-baths, as is the worm in the worm-tub in or-

dinary

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dinary distillation. It is farther obvious, that this mode of distillation may combine, when it shall be thought proper, all the known advantages employed heretofore by the distiller. The shafts of the agitators may be readily driven by machinery, and several connected on any scale, if required. The various parts of the apparatus connected by tubes, may have these tubes either of a curved or any angular form most suitable, though C and O, the connecting tubes of the diagram annexed, are exhibited as being at right angles. In many instances one refrigeratory, with its agitator, will be found adequate to every purpose.

The numerous applications of these improvements, as connected with agitation in a liquid medium, coupled with condensation by liquid or hydrostatic pressure, and of ready detachment of the several parts of the apparatus, with other very obvious advantages, it would be needless to detail. Wherever they are found applicable to the processes of combination and condensation of gases and vapours applicable to the processes of distillation, I claim them as my particular and individual discovery, for which his Majesty has been pleased to grant his letters patent.

In witness whereof, &c.

Specification of the Patent granted to THOMAS WADE, *of Nelson-place, Kent-road, in the Parish of St. George Southwark, in the County of Surrey, Gentleman; for a Method or Process of imitating Lapis-lazuli, Porphyry, Jasper, the various Sorts or Kinds of Marble, and all other Stones usually wrought, carved, sculptured, or polished, also inlaid or Mosaic Work, to be used for or in the Formation or Manufacture of Chimney-pieces, Slabs, Funeral Monuments, and for every other Purpose to which such Stones and Marbles are or may be applied.* Dated July 26, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Thomas Wade do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in the following explanation thereof; that is to say: I make use of a composition somewhat resembling that employed in the manufacture of earthen-ware, pottery, or porcelain; of which I mould, form, or make the various pieces of slabs, and I work or fashion them to the desired shape by the modes usually known or practised in the earthen-ware or porcelain manufacture. But as pieces of large dimensions and considerable thickness formed of the materials generally used in the above manufactures would be apt by fire to lose their proper shape, and become warped or uneven, I prevent that defect by proper addition of sand, chalk, bone ashes, selenite, coarsely powdered glass or flint, or by an admixture of all or some of these, but which in particular, or

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or the precise proportion of any or either of them, can only be ascertained by experiment, as clays differ materially from each other; and the same bed of clay is of different qualities in its different parts and at various depths; as it still sometimes happens, notwithstanding the above precaution, that the slabs, parts, or pieces, in or by the process of baking or burning, may be warped, bent, uneven, or untrue, I carefully examine them, and should that be the case they are brought to an even or true shape, or surface, by rubbing with sand-stone, rasping, filing, or by other convenient means. Should the article intended to be made require to be composed of several constituent or smaller parts, as in the case of chimney-pieces, I drill or make holes in the particular parts of the various pieces where they are intended to be joined, in order to admit brass or other cramps or pins for the purpose of holding them more firmly together when joined or set up. And if the piece be intended to imitate or resemble carved or sculptured stone or marble, I flute, or otherwise carve, mould, or shape it accordingly, previous to the process of baking or burning. Sometimes I do contrive or form the slabs, parts, or pieces, that where they are joined together there is a fluting, reading, or moulding, by which the joint is partially or entirely hidden or concealed. Sometimes I stamp or mould small ornaments or devices, accorcing to the pattern to be imitated, and afterwards I fix or attach them to the surface of the slab or piece, as is usual in the above-mentioned manufactures. It is found necessary to round the edges in a very trifling degree, as the glaze or enamel does not well cover, or easily spread over very sharp edges; besides, by being rather rounded,

ed, they are not so liable to be chipped or broken. I then bake the slabs, parts, or pieces, in a furnace or kiln, such as is in use with potters: afterwards I print or paint them with enamel colours, with the necessary designs, and in the proper manner, to imitate or resemble the various sorts or kinds of marbles and stones, as well as inlaid or Mosaic work. In performing this I avail myself of all the various artifices used by potters, japanners, marbled paper-makers, and others, to paint the different patterns, designs, or devices; such as printing them on damp paper and transferring the impression off, tracing the designs, or employing artists to paint them. Here it must be observed, I sometimes lay on the enamel colours, and afterwards put a transparent glaze over them; at other times I use opaque enamel, as best suits the nature of the work, to imitate polished, white, or statuary marble. I cover the pieces when moulded, fluted, and ornamented, with the whitest and most beautiful enamel. The glaze or enamel I make use of does not differ from enamel in general use, except that I never use glass of lead when the colours are of a delicate cast, and more especially when the work is intended to imitate or resemble white or statuary marble. After the pieces are painted they are again exposed to the fire in a kiln or furnace, when the enamel is melted or vitrified, and they become covered with a glassy shining surface, not easily matched, and which seems peculiarly adapted for monumental tablets with inscriptions, as they can scarcely ever be defaced or obliterated.

In witness whereof, &c.

Comparison

Comparison of the relative Value of British Coin.

Communicated in a Letter to the Editors.

Gentlemen,

The following curious facts, occasioned by the present state of British currency, deserve to be recorded; and may be of use to the philosopher who shall consult your pages at some distant period.

	£.	s.	d.
A guinea made of standard gold, weight 5 d. 9 grs. passes by law for only	1	1	0
The same, three grains lighter, is worth, as bullion	1	5	6
A crown piece, made of sterling silver, weight 19 dwt. 8 grs. passes by law for only	0	5	0
A bank dollar, weighing two penny weights *less*, and the silver 2½ *d.* an ounce *worse*, is current for	0	5	6
A half crown piece of sterling silver, weight 9 dwt. 16 grs. passes by law for only	0	2	6
A bank token, weighing five grains *less*, and the silver 2½*d.* an ounce *worse*, is current for	0	3	0

The lesser bank token of eighteen pence weighs 1 dwt. 2 grs. *less* than a shilling and a six-pence, and the silver is also 2½*d.* an ounce *worse.*

Any person who buys an ounce of standard gold, and pays for it in coin, will receive ten pence in change for four guineas and two seven shilling pieces.

A bank of England note for one pound purports to be the representation of 5 dwts. 3 grs. of standard gold; but

but at the present nominal price it will purchase not quite 4 dwts. 4 grs.; its deficit is 23 grains, and its consequent depreciation three shillings and seven pence.

Yours, &c.

London, Sept. 17, 1811. B. S.

Improved Mooring-Blocks for Ships. Invented by Mr. SAMUEL HEMMAN, *of His Majesty's Dock Yard at Chatham.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal of the Society was voted to Mr. HEMMAN *for this Communication.*

THIS mooring-block, from its construction and weight, is decidedly superior to any anchor whatever; similar blocks (Fig. 1. Pl. XVI.) have been appropriated to that service at this port since the year 1801, by the Directors of the Honourable Navy Board, and in no one instance have ever been displaced, notwithstanding we have had very severe weather since that time. As a proof of their holding fast in the ground, I shall adduce the following circumstances to prove the assertion :—It was found requisite to remove one of those mooring-blocks; two large lighters with purchases in each, adapted for that purpose, with about forty-five men, were sent to weigh it, but their united powers were not adequate to the task; recourse was then had to the rising of the tide to dislodge it. The largest anchors appropriated to the moorings for a ship of the line are from sixty-five to eighty cwt. and those sizes are found insufficient at times, whereas

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whereas the weight of a mooring-block is about one hundred and fifty cwt. which is sixty cwt. heavier than a first-rate's anchor, besides a form better calculated to hold in addition to its increased weight; this double advantage will allow a reduction from the length of the chain, which is very expensive; and in one pair of moorings for a ship of the line a saving of about 874*l.* will arise out of 2,472*l.* the present expense of a pair of moorings with anchors. There is another advantage by adopting these blocks, *viz.* there are no anchors appropriated to moorings but might be made serviceable; and should there be no defective anchors in store, we are necessitated to take sound ones. I must farther observe, that there is no species of stores in his Majesty's navy that is so difficult to procure as large anchors, owing to the want of anchor-smiths; and moreover an anchor of seventy-six cwt. will take upwards of thirty days to make it, whereas a mooring-block may be cast in as many hours; besides, there are but few smitheries competent to make large anchors except in his Majesty's dock-yards; but a mooring-block can be procured at all the iron founderies in the kingdom. These are circumstances of the highest importance.

I was induced to try an experiment of laying down a pair of moorings of this description, from the necessity of mooring a ship in a situation where there was not room for her to swing, provided the bridles attached to the moorings came in at the hawser-holes, which is usual. Accordingly I laid down a pair, and moored the Maidstone frigate at them; she has been there about four months, and I find those moorings answer the desired purpose. The ship turns with the wind or tide occasionally.

The bridles come in at the fourth port from forwards on each side the swivel (as shewn in the plate) under her bottom; this gives facility to the ship, and keeps the ground-chain clear. Moorings of this description will answer for ships of all sizes, provided there is a sufficient depth of water under them.

Certificates.

These are to certify, that his Majesty's ship Maidstone has been placed at the Weathercock-moorings, within the entrance of St. Mary's creek; that I have resided on-board of her since the moorings were laid down, which was in June last, and that they answer extremely well.

And I do farther certify, that many of the line-of-battle ships in my division are moored with Mr. Hemman's cast-iron mooring-blocks; that they ride in perfect safety, and in my opinion are superior to any anchor whatever: moreover, the service derives great benefit from them.

Given under my hand this 13th day of Nov. 1809.

A. SHENNAN,
Superintending-Master of the First Division.

This is to certify, that Mr. Samuel Hemman, the master attendant at this port, has moored a number of his Majesty's large ships in the river Medway with cast-iron blocks instead of anchors; that all these ships ride perfectly safe, and I strongly recommend the use of them in preference to anchors.

G. JOHNSON,
Boatswain and Pilot of His Majesty's Ships at the Port of Chatham for many years.

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Reference to the Engraving.

Fig. 2 (Pl. XVI.) is a perspective view, wherein A A is the stock made of two beams united together by hoops, and by that means fastened round the shank B of cast-iron; CCC is the fluke, made, as in the figure, of such a form as to take the greatest hold in the ground, its lower edge being sharp, but the full width, so that it has an edge but no point. D is the swivel which connects the shank to the mooring-chain. E is a part of the shank projecting through the fluke, having a hole through it to receive a buoy-rope to take up the anchor when necessary. This mooring-block weighs one hundred and fifty cwt. the principal part of which is situated in the fluke, the edge of which is thereby forced into the ground, so as to take good hold.

Figs. 3 and 4 explain Mr. Hemman's method of mooring a large ship in confined situations, where there is not sufficient room for her to swing if the bridles came in at the hawse-holes in the usual manner of mooring.

Near A, Fig. 3, is the hawse-hole of the vessel where the bridles of the mooring-chain are generally brought in. C are the bridles in the improved method. D are wooden bolsters projecting from the ship's sides so far as to keep the two hawsers E clear of their bottom, as shewn in Fig. 4: these hawsers are united in the swivel F, and this with the mooring-chains G G, which proceed to two blocks, similar to Fig. 2, one of which is shewn at H, the opposite one does not come within the limits of the plate. I is supposed to be the line of low water, and K the surface of the ground.

An improved Implement for extirpating Docks and Thistles. By Mr. John Baker, *of West Coker, near Yeovil in Somersetshire.*

With an Engraving.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Gold Medal of the Society was voted to Mr. Baker *for this Communication.*

I HAVE sent to the Society an implement of my invention for destroying thistles and docks, which are two very injurious weeds.

The implement is so contrived, that if the root breaks in the claw in attempting to draw it, you may, by turning the instrument, cut the root so far below the turf as to prevent its growth.

Reference to the Engraving.

A, Fig. 5, (Plate XVI.) is the handle; B the claws, between which the thistle is received; the curved iron, C, is the fulcrum, over which the purchase to extract the weed is obtained; D an iron rod, or bar, upon which the foot is placed to thrust the claws into the ground. In case the root of the weed breaks in endeavouring to extract it, the curved blade E, which has a sharp end, like a chissel, is thrust into the ground to cut off the root of the thistle some inches below the surface, and prevent its vegetation.

Or-

Fig. 5.

Fig. 1.

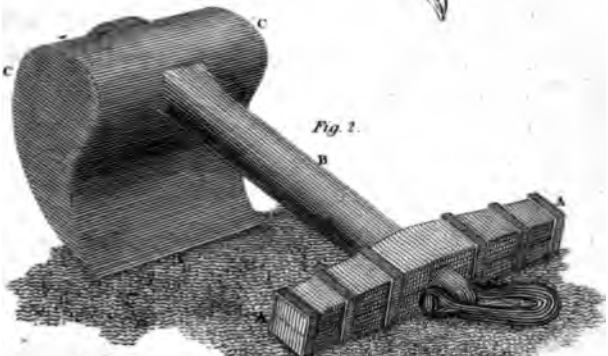

Fig. 2.

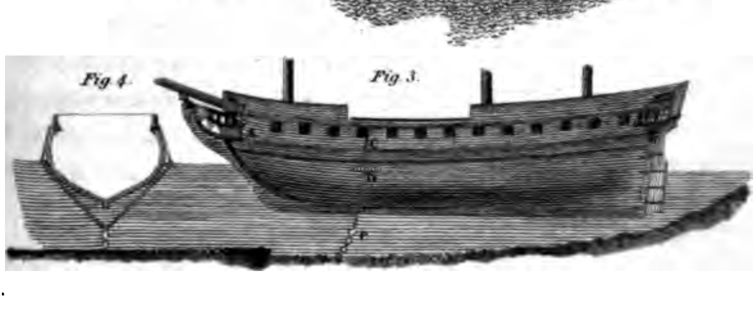

Fig. 4. Fig. 3.

On the Acacia Tree.

By the Rev. J. Willis, *of Sopley, near Ringwood.*

From the Communications to the Board of Agriculture.

IT has ever been my wish to convey to the Honourable Board of Agriculture any information that may be of use to the public as well as to the individual. I beg leave, therefore, to submit to your consideration, a few facts relative to the Acacia, which I hope will induce other gnetlemen to cultivate this tree; and which, I think, I can illustrate, by certain examples, to be one of the most valuable among those that we are now raising in our plantations. I am inclined to believe that the specimen and its history, which I now transmit to the Honourable Board, will most fully prove, to your conviction, that if quality of timber, or wood of real use, with quantity, in any given time of growth, be taken into consideration, there is no tree in the generality of soils will reward the labours of the planter more satisfactorily than this species of acacia I am now permitted to describe. In rapidity of growth, this tree in some soils will equal the poplar or willow tribe; and at the same time it possesses the durability and closeness of texture of the yew and the box. The specimen is part of a tree I planted in a pure gravel, trenched three feet, with many others of different kinds, in the year 1782; it has been cut down two years, and I have made several book-cases of it for my library, and other things for the use of my family. It is certainly well adapted for all cabinet purposes, from the beauty of its feathering and closeness of grain. I have some beautiful grained planks

planks by me now, which would make the styles of drawing-room doors, or any ornamental furniture. The coarser parts of this timber I have applied to farming and other out-door purposes, which I find equal to oak in its wear and tear. In the same year, and in the same gravelly soil, I planted firs, Lombardy poplars, and weeping willows; one of the poplars now measures eight feet two inches in circumference, and is seventy feet high; and I brought the cuttings of the poplars, in my portmantua, from Lord Rochfort's plantations at St. Osyth's, in Essex, no bigger than a tobacco-pipe. I mention this circumstance to prove to those young men who now are beginning the world, and have wealth and scope of ground, and wisdom and foresight enough to apply both to their own advantage, as well as that of the public, that they should omit no opportunity of planting every inch of ground within their domains that is not applied to grain; and whatever be the nature or quality of the soil, if they go judiciously to work, some sort of tree or another will assuredly reward their labour.

I really despaired myself, when I first planted this rock of gravel, of any sort of tree vegetating in such a situation; but a few years have amply rewarded my pains, by giving me many hundred feet of timber, of various kinds, and at a time when, perhaps, it never before carried such enormous prices. I must not omit saying, that I have been offered by a carpenter 3*s.* 6*d.* *per* foot for some of my acacia planks, which are from the saw an inch and a quarter thick. There are but few trees of English growth that will exceed this in price.

It may be necessary to point out the species of acacia I am now recommending, and I shall state, for that purpose,

pose, the following extract from Miller's Dictionary. "*Gleditsia polysperma*, three-thorned Acacia. This tree is common in most parts of North America, where it is known by the name of the Honey Locust; is called by the gardeners here the three-thorned Acacia; it rises with an erect trunk to the height of thirty or forty feet, and is armed with long spines; leaves bipinnate, composed of ten pairs of leaflets, of a lucid green; the flowers come out from the side of the young branches, and being of an herbaceous colour, make no great figure: legume near a foot and a half long, and two inches broad; seeds smooth, surrounded by a sweet pulp."

There is a tree of this sort in the Bishop of London's garden at Fulham, which produced pods in the year 1728, that came to their full size, but did not ripen: it appears from Pluknet, that it was cultivated by Bishop Compton in 1700. This is an elegant tree, and grows best when most sheltered; it should have a deep soil; if the ground is strong and shallow the tree becomes mossy. It is propagated by our gardeners from seeds procured from America, annually sent to England by the title of locust, or honey-locust, to distinguish it from the false acacia, which is frequently called locust-tree in America.

Notwithstanding the authority here quoted, that a deep soil is requisite for its success, I am inclined to believe, that it is a tree of that hardy nature, that it will flourish in a variety of soils and situations, of which I shall point out a few of the most opposite, which this neighbourhood has afforded me an opportunity of selecting. The specimen sent, was planted by myself in a rock of pure gravel, but thoroughly broken and trench-

ed, as I have before observed, three feet deep, without a particle of mould, and rather an exposed situation. The trees were about thirty feet high before I cut them, and were certainly in a very thriving condition. Nothing would have induced me to have removed them, but they were getting too lavish for their situation, as they destroyed some other plants beneath them.

There are now growing in the gardens of Ibsley, near Ringwood, in a bank of gravel, some trees of this species, in a very healthy growing state.

There are also some of this species growing in a strong loamy soil at North End, near Ringwood: they certainly grow more vigorously than those on gravel, and promise to be very valuable trees. The largest tree growing in this country is on a bed of pure chalk, in the gardens of Whitsbury-house, near Fordingbridge, belonging to Lord Shaftesbury.

In the grounds of the Rev. John Helyar, at Turnham, in Dorsetshire, an acacia was planted as a shrub, in the front of a rustic cell, but its increase was so prodigious and rapid, that it overcame all opposition of pruning: in a few years this tree has over-shadowed the grotto, and completely hid it from the parlour windows: but, I must observe, that this luxuriant acacia is now growing in a bed of flints intermixed with chalk; and, I am told, the hole in which it was planted filled with water the instant it was dug.

Here it may be useful for the planter, that I should repeat again most distinctly, that at Soptey and Ibsley the acacia grew on a pure gravel; at North End, in a strong soil; at Whitsbury, on a chalk; at Turnham, in a bed of flints, through which runs a continual stream of water: these instances are strong proofs of what I premised,

mised, that the acacia will flourish on the most unpromising soils.

In America, where this beautiful tree is indigenous, it is every where seen in the wilderness, on the plain, in the valley, on the mountain. It is found to the Southward, on the borders of the gigantic Misisippi; and in the United States, from Georgia to New Hampshire. Lord Valentia, in his travels through Abyssinia and Egypt, lately published, says, that the villages and gardens, as they proceed, were protected by a fence, formed from large branches of the thorny acacia; and in other places of this entertaining work, we find his Lordship informing us, that the acacia grew to the height of forty feet in some situations, and nearly covered the face of some countries they travelled through. Thus it appears to agree with most soils in any exposition, and with the extremes of hot and cold climates.

If I am informed correctly, by an American gentleman, it is the only tree the natives select for planting for shade and for ornament: a new settler too hastily, with a remorseless axe, clears every thing before him; but he soon finds in his habitation the scorching rays of a vertical sun, which compels him to create a shade in planting the spreading acacia, which he had incautiously removed, and which a little foresight and prudence would have induced him to have spared. Woods judiciously cleared, and clumped in different positions, must afford an agreeable shade and shelter for their habitations, especially from the tinted foliage, and elegantly pendant flowers of the acacia: the sweetness of its pulp contained in the pod is very attractive of bees, and which circumstance has, in America, given it the name of the honey locust. As timber, it is also in great

repute in America in ship-building, where straight wood is required for top timber, timber heads, &c. &c.: but for one particular purpose it is almost invaluable, and that is for trunnels, or wooden pins, which bolt the outside planks to the inside timbers of a ship, which must be considered by us as a very material article in naval architecture. I am informed of a vessel, now in the Greenland trade (the Manchester of Hull), that was built 40 years ago at Philadelphia of live oak and yellow pine plank, driven with locust or acacia trunnels; she has been in constant employ, and was lately overhauled at Mr. Mastner's dock: the trunnels were driven back with great difficulty, and were found to be as perfectly sound as when they were first put in. Millions of trunnels are brought into this country, which are bought up by the ship-builders, who prefer them for their toughness, their never shrinking, and their aptitude to drive better than any other description of wood. This tree in America is found from four to five feet diameter: the roots run large and crooked, and from their excessive toughness, are much sought after for knees for small craft and boats. I have seen lately something of an introduction spoken of earthen-ware sheaves in the blocks of the ships in the navy. Surely this must be too brittle a substance, so very essential to the movements of a ship, in performing those powerful and active operations, in which the blocks are employed. This part of the machinery hitherto has been made of the hardiest of woods, and cast metals; and from the experiments I have made of the acacia, I rather think this wood would make more durable sheaves than those of earthen-ware, however compounded, and very little inferior to *lignum vitæ*. The fate of the nations around us has wonderfully

revolutionized

revolutionized the things of the world, and among these changes, timber of all kinds, foreign and domestic, has tripled its value; Scotch fir, beech, and even inferior woods are now used in buildings, where they were never applied before: necessity has even introduced the poplar tribe, as a miserable substitute in some instances for red and white deals. I have seen some parlour floors and doors made of Scotch fir, cut when the sap or turpentine was up, that stand tolerably well; if these were constructed of acacia, I have no doubt of their enduring for centuries. The thinnings of the old Duke of Cumberland's plantations at the Virginia Water, I am told, now sell from 2*s.* to 3*s.* *per* foot, which are chiefly of Scotch fir. If the Duke had known in those days the value of the acacia, and had intermixed them with other trees in his plantations, what an immense difference in point of money, and in paying for the use of the land, on which they grew, would the thinnings of the acacia produce? This soil would carry the acacia well, and would pay a *per centage*, *per* acre, superior in my opinion to any other wood. My time would fail me on this occasion, were I to enumerate the examples of gentlemen in England and Scotland, who are at this moment receiving immense advantages, even from the very thinnings of their plantations. This consideration, as well as the great demand, with the consequent rise on all sorts of timber, most fully declare the absolute necessity of applying every foot of our wastes, that is not adapted to the product of grain, to the growth of timber; the species and quality of the tree to be suited to the nature and quality of the soil. A judicious cultivator will use his strength and resources accordingly; the best part of his wastes will carry corn; the inferior

many sorts of timber, that are most likely to agrée with the situation and soil. But many gentlemen have misapplied their money and their exertions, both in planting of a grain and a species of timber, by no means agreeing with the nature of the ground, which they have broken up from a state of nature. The quality in all respects should be the first thing considered, its strength, its weakness; next the elevation or lowness of situation; then the fitting of the grain or tree to its allotted place. Here then is a field calling forth the nicest judgment of the cultivator; and in this discrimination, the future ill or good success of the undertaking wholly depends: the not duly considering the different qualilities of waste land, which require as many different modes of application and management, has been very prejudicial to the individual interest of certain gentlemen, who have inconsiderately and hastily embarked in these speculations; their plantations have failed under an improper management and selection of trees and soil; they have been too disgusted with the unsuccessful experiment to renew their labours; and the whole has been permitted to return again to a state of nature. A friend of mine some years back planted some thousands of the acacia or locust tree on a cold black sand, with iron stone at the bottom, on the waste near Ringwood, in Hampshire: they existed for two years; then every plant died. Perhaps there cannot be really a worse soil in the world to plant a tree on than this. I have seen the pinaster and Scotch fir yield to this situation; vegetate for a year or two, and then perish for ever. If my friend had maturely examined the nature of the ground, and its substratum, we must deem him more than imprudent if he had persisted in an undertaking by which he lost

lost some hundred of pounds. However, in some places in this vast waste, this iron stone, where it has been only two or three inches thick, has been broken: here the roots can expand, and the trees, chiefly Scotch firs, are growing as well as in most other situations.

Planting of timber judiciously, that is, suiting the tree to the soil, appears to be next in consideration to the planting and fitting of that species of grain to the quality of the land that promises to afford most food for the people. In the present state of things, every possible exertion should be made to raise both, and both are now of such vital and essential importance to the welfare of the state, that the concern really becomes national: as such, if men were not governed by prejudice more than by reason, one half of the military not on duty should be instantly employed in cultivating the wastes of the kingdom. Think only on the vast advantages of the profit on the labour of ten or twenty thousand men for one day: multiply it by 365, deducting the Sundays; then imagine what mighty public works might be accomplished for the comfort and happiness of this nation. I am convinced that the time is not far distant when we shall see these things as we ought, for the general good of all. Indeed, the ruler of France has already given us a lesson on this subject. I read this on a report of the state of Antwerp: "there are about 800 soldiers at work at the new bason, which will be ready in three years; there are 600 men at work in the dock-yard, ship-building, &c. &c.; these are ship carpenters and soldiers likewise; so that the whole number of men, fighting men, that are at Antwerp does not exceed 2,400 men. Their resources for ship-building from the Black Forest,

Forest, through the Rhine, are inexhaustible; the mechanics employed in building these nine ships of the line are all young men, and chosen from the conscriptive levies; they are formed into military as well as into labouring order: there are at least a company to each ship building, under the superintendance of a captain. Every Sunday they are exercised to military discipline. All their work is carried on with amazing rapidity." What Englishman can read this without being animated; without urging his fellow countrymen to similar deeds? Look at our military unemployed, when public roads, immeasurable wastes, fit for corn and timber, bridges, canals, harbours, the work of all our dock-yards, might be wonderfully improved and accelerated by the immense increase and addition of that labour which we are daily throwing away, and which our enemy is taking a most tremendous advantage of!

I hope the digressing used in this address will be pardoned. I have certainly been led away from the original subject of the acacia to others, which must at this time very forcibly impress the mind of every thinking Englishman, who wishes to see every resource and advantage of this kingdom fairly and properly applied, civil, military, and agricultural; all conspiring to the same views, and uniting in the same great object, of most anxiously maintaining the interest, the credit, and the spirit of our nation.

Memoria

Memorial upon Irrigation. By DAVID SHANK, ***Farmer and Tenant in Low Curghie, Wigtonshire.***

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

The Silver Medal was voted to Mr. SHANK *for this Improvement.*

IN the district wherein Mr. Shank resides, *viz.* the Rhins of Galloway, irrigation is not practised by any other farmer, and little or imperfectly by any proprietor.

His attempt, or experiment, commenced in November 1809, in a small field, admirably adapted for such an operation. He had adverted to the peculiar situation of the field for several years: and although the land is well adapted for tillage, yet as grazing is a great object in this country, it occurred to him, that this small field, converted into a water-meadow, would be of essential value to his farm. In Spring 1807, therefore, after the field had been richly prepared by a drill-green crop, he laid it off in ridges of thirty feet wide. It was then sown with barley and grass seeds, and in the centre or crown of every ridge or furrow, was drawn by a water-furrow plough, in order to suit the purposes of irrigation in after years. The barley was more luxuriant than productive, and the grasses yielded well, but a considerable part was cut and used green for horses, as soiling in summer 1808. The tenant conceived, that it would be proper to allow the land to consolidate for another year before admitting the water, and accordingly a crop, partly for green food and partly for hay, was taken in 1809. This crop, however, was considerably inferior to the former;

former; and in the end of October or beginning of November, 1809, the long-proposed irrigation commenced. A dam-dyke of turf, the most simple of all materials, was constructed at the lower end of a glen or dingle, upon the upper side of the field, and an easy level was found for a feeder across the field. This, by means of stops, conveyed the water into the centre furrows before described, and thus the water was distributed over the surface.

The rivulet being small, it was only after falls of rain that irrigation was complete, more particularly as the subsoil is very porous: but every attention was paid so as to obtain the greatest possible benefit. The process was continued until about the middle of March, and a second dam was constructed half way down the field, so as to give the lower part as much advantage as the upper. The Spring is late in this country; but this little field exhibited an early verdure, far surpassing any thing in this neighbourhood. Part was cut for soiling, being earlier ready than any sown grass; but the greater part was allowed to stand for hay.

April, May, and the first half of June 1810, consisted of dry and unkindly weather, so that grass of all kinds was extremely backward.

In this same field there are several little eminences, which could imperfectly, if at all, receive benefit from the water. These, together with the porous subsoil, upon which almost the whole field is incumbent, admitted the injurious effects of this long-continued drought, and of course the crop was considerably shortened of what might once have been expected.

By the certificate accompanying this statement, four acres, Scots statute measure, were under irrigation; and two

two roods nine poles weve too elevated to receive much advantage therefrom. Before the end of June, however, the hay was cut; and as soon as the weather would permit ten ricks were secured. These ricks averaged 76 stones, each of 26 lbs. averdupois, *per* stone, and it was calculated that not less than 100 stones were consumed green. Thus the produce will amount to not less than 860 stones, or about ten tons, being at the rate of 190 stones, or more than two tons *per* acre. This exceeds very considerably the produce of 1809, and the field is reserved for the purpose of annual irrigation, all parts where the water cannot properly extend being now richly dunged. These parts, however, are trifling, when compared to the whole extent.

This land, before irrigation began, and in its improved state, might be worth 45*s*. *per* acre upon lease. Hay in this country is well worth 6*d*. *per* stone to the farmer.

The aftermath or foggage has been worth 20*s*. *per* acre; so that the field in question can scarcely be managed in any manner so profitably as by the means recently adopted.

The water was shifted from side to side of the field, according to the advice of the English irrigators, so as to dry and drown the land alternately; but one small hollow was unavoidably under water all the time, say about four months and a half, and here the grass was by far the most luxuriant. It would appear, that in England this might have been prejudicial, but the different effect may have been produced by an essential difference of climate. Something may also depend on local situation, the cool sea breezes tending to prevent that putrescence of the water and herbage upon the surface, which is understood to take place in a warmer and in-

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land country, when irrigation remains uninterrupted beyoud a certain length of time.

The expense of irrigating this field is exceedingly moderate. The two drains and feeders could not cost above 30*s.* and the subsequent operations can scarcely be reckoned on, as they afforded amusement to the occupier, who conducted them with his own hand.

Rye grass, clovers, and rib grass, were the seeds sown. The tenant was aware that natural and meadow grasses might have been more advantageous, but he has already the satisfaction of seeing these rapidly introduce themselves; and although without pretensions to knowledge in botany, he apprehends these sweet natural grasses chiefly to consist of *Poa pratensis* and *Poa trivialis.*

We, Patrick M'Master, in Clonyard, and Edward Kerr, in Kilstery, farmers, do certify and attest, that the foregoing Memorial contains a fair and correct statement of facts, according to the best of our knowledge and belief, we having had many and frequent opportunities of inspecting the field therein described, and the produce obtained therefrom.

PATRICK M'MASTER.

Kirkmeridan, Jan. 7, 1811. EDWARD KERR.

Mr. John Scott, of Low Curghie, gardener and land surveyer, has measured a field under irrigation, occupied by Mr. David Shank, and found the whole contents of the field to be four acres, two roods, nine poles, Scotch statute measure, whereof the two roods and nine poles very nearly consist of detached pieces too elevated to receive the water, and the four acres Scots, being a fractional part more than five acres English, have been completely and successfully irrigated.

Observation

Observations on the Art of Glass-making, explaining some of the Phenomena that occur in the Process, with Directions for applying them to effect new Products.

By M. GUYTON MORVEAU.

From the ANNALES DE CHIMIE.

THE art of glass-making, which is of the highest antiquity since there exist monuments that attest it to have been practised by the Phœnicians, was a long time carried on only by the tradition of processes which had generally succeeded. At the present period we feel the necessity of developing the principles of the art, the application of which has successively displayed the essential conditions of the operations, augmented the products, ameliorated the results, and may yet lead to further improvements.

Such was the object proposed by M. Loysel, in 1791, in the Essay he presented to the academy of Sciences, and who, under this modest title, has left far behind him the works of Nery, Merret, Kunckel, and others, who have written on this subject.

The work still more recently undertaken by M. D'Artigues gave hopes of a treatise that would embrace every part of this art, and put it into a regular course of practice.

The two memoirs that M. Artigues has already communicated to the class, have drawn my attention to some facts noted in my own collection, which appear to me to have a sufficiently intimate relation to the most important phenomena in the operations of this art, to

 merit

merit publication. I shall state them succinctly, with reflections that may serve to elucidate the theory.

The principal objects of these observations are:

1st. The separation of glass of different degrees of density by liquation.

2d. The results of attempts to anneal large masses in crucible-moulds.

3d. The colouring glass red with copper and by cementation.

4th. The alteration of glass by long continued heat.

5th. The alteration by the furnace fires, compared with that which is effected by volcanos.

6th and last. An examination of what really constitutes the difference of the transparent and devitrified glass.

First Observation.—Separation of Glass of different Degrees of Density, by Liquation.

In 1776 I accompanied M. de Buffon to the manufactory of glass then existing at Rouelle, near Langus, under the direction of M. Allut, to whom we owe the article *glacerie* in the Encyclopedia.

He had proposed to make experiments for the fabrication of a mass of flint-glass fit for the construction of graduated lenses, described in the first volume of the Supplement. I shall not speak of the various processes employed, and of the difficulties that obliged him to renounce the hope of obtaining a single piece of sufficient thickness. I shall confine myself here to the very extraordinary result to which I was witness, and which I think may be compared to that which in metallurgy goes by the name of *liquation.*

There

There was poured upon the copper table a mass of the composition of flint-glass, to a thickness of 37 millimetres *. There remained in the crucible a portion of this glass, as high as three or four fingers deep; it was imagined that by recharging it with the ordinary composition, the glass obtained from it would be as much finer in proportion as it partook of the quality of the flint-glass. The refined glass being laded into the *cuvette*, and poured upon the table, to the thickness of three lines (from 6 to 7 millimetres) was put into the annealing oven to cool. When it was taken out again we were eager to judge of its quality, but were much astonished to find, instead of a single piece, two very distinct plates, of which the line of separation was perfect, and extended through the whole mass, the lower plate forming about the third of the thickness. I brought away a piece which I exhibited to the Academy of Dijon, and which has been deposited in its cabinet.

It was already well known that glass which contained in its composition a considerable quantity of oxyd of lead, with difficulty produced a mass perfectly homogenous, because the parts that are the most dense are not retained by an affinity capable of producing an equiponderance; and hence arises the difficulty of obtaining flint-glass free from streaks. But a precipitation so rapid and so complete is a singular example dependant on a combination of circumstances which we can hardly expect to see reproduced.

We can hardly doubt, after this, that the streaks from which glass charged with oxyd of lead is so rarely

* The composition was 32 of Madagascar rock-crystal pulverised, 32 of minium, 10 of soda, and 1 of nitre. Elemens de Chimie de Dijon, tom. I. p. 179.

rarely exempt, proceed from a commencement of liquation. The horizontal direction of these streaks demonstrate it, since they are not very distinctly perceived but when the light falls upon the eye in a certain direction.

I have preserved a piece of flint-glass of the thickness of three *centimetres*, which one might judge to be of the best quality, if it were not that the part of separation is slightly waved.

Second Observation. — Essay with Crucible-Moulds for annealing large Masses of Glass.

Among the number of experiments made at the manufactory of glass at Rouelle for the same object, they at first employed a hard calcareous stone cut into the form of a circular crucible, imagining that when it was converted into lime by a gradual fire, and without losing its form, it might hold the refined glass; so that the matter contained in it would undergo the same gradual cooling as takes place in the annealing-oven. They obtained, however, only a mass that was crowded with bubbles, and swelled on the surface.

They tried with the same views, a crucible made of the best potters clay baked as hard as possible: the glass was perfectly refined in it, and preserved in the annealing state all its homogeneousness, but the mass, which was seven centimetres in thickness and 120 in diameter, was divided by fissures proceeding from the centre to the circumference, because the adherence of the glass to the sides of the crucible had prevented its contraction, and the clay being so hard baked was not susceptible of so great a diminution of bulk in cooling.

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I have preserved a piece of this mass, the transparency of which is remarkable for so great a thickness, although the composition was not prepared with an intention to deprive it of colour.

Third Observation. — Plate-glass coloured red with Copper.

Up to the present time we have not possessed any other method of giving a red colour to glass, either for church windows or to imitate precious stones, but that of combining in various proportions according to the shades desired, the oxyd of gold, oxyd of manganese, and sulphuret of antimony. Such are the compositions described by Fontanieu, and in the essay on glass-making by M. Loysel.

Clouët has given a different process in his essay on the composition of enamels, the manuscript of which he communicated to me some years ago, and I published it in the Annales de Chimie, for May 1800. This process consists in fixing the colour of the red oxyd of iron, by calcining a mixture of sulphate of iron and sulphate of alumine; but it announces decidedly that there is no metallic oxyd which directly produces a clear red; that to compose this colour different substances are necessary, and that it would be useful to multiply experiments by which that red might probably be produced, *which cannot be attained either directly or easily by any of the metallic substances anciently known.* In fact, he only speaks of the oxyd of copper as used in the preparation of green enamel; and though it has sometimes afforded a tolerably fine red, especially by mixing it with oxyd of iron, he informs us that this colour is very

fugitive, and often disappears even during the working of the glass.

An accident happened at the glass-house at St. Gobin in 1783, which appears to me to have pointed out the circumstances in which we may hope to fix in the glass the colour of the red oxyd of copper; and an experiment made in the laboratory of the Polytechnic school supports this conjecture.

It is the practice in plate-glass works, when the glass is sufficiently refined, to lade it out of the glass pots into a large moveable crucible, called the *cuvette*, which latter is then withdrawn from the furnace, and its contents emptied on the casting-table. The operation of filling the cuvette (called *trejettage)* is executed with copper ladles that have iron handles, and which must be plunged into water as soon as they begin to heat. A workman having neglected this precaution lost a part of his ladle, and it was imagined that this melted piece would precipitate in a metallic state to the bottom of the crucible, and would be preserved the same as under a vitreous flux; the casting and annealing were completed as usual, and they were extremely surprized to see that the glass, independant of some metallic grains, that were dispersed in the body of it, presented streaks almost uniformly coloured of a lively red. I send to the Class a portion of this glass polished on one side, which was 17 centimetres long, 12 wide, and 7 millimetres thick.

It is certain that this red colour was owing to the copper that was suddenly carried to the degree of oxydation, which gave it this property, and was fixed in this state by its diffusion in the vitreous mass; but are there any means of re-producing the same concurring circumstances,

cumstances, and what processes must be used? This is what I wished to discover by experiment.

We took a piece of pulverised plate-glass, and mixed it with 3 *per cent.* of its weight of copper filings, and after having pushed this mixture to a perfect fusion, we found a glass without colour, and the copper in metallic globules.

The experiment was repeated with goblet glass and 6 *per cent.* of its weight of copper filings; a vitreous mass was obtained of a very equal red colour, but so dense, that it appeared more like enamel than glass. We distinguished on the surface a less compact crust, approaching to the nature of scoria, which was of a brown colour inclining to black.

Mixtures of glass and copper, even in the lowest state of oxydation, gave only a greenish shade, and a part of the copper was reduced.

These results; at the same time that they prove the possibility of producing a red glass with copper, confirm the opinion of Clouet, on the difficulty of fixing this colour by fire. It seems to me, that it would be difficult to account for the circumstance of the plate-glass affording only reduced copper, whilst the goblet glass gave a vitreous oxyd, by supposing that the last contained some oxygenating substance: a more probable reason is, that the greater fusibility of the former glass hastened the fusion of the copper, and thus protected the metal from the oxydating action of the air before the temperature was sufficiently raised to render this action efficacious.

I need not remark that this is not at all in contradiction to the phenomenon that I previously described,

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since the copper of the ladle did not pass to the state of vitreous oxyd in the plate-glass till it had repeatedly undergone the combined action of the air, and the heat of the furnace.

M. D'Arcet has made several attempts to colour glass with cements charged with metallic colouring oxyds; he has employed in different proportions and in different states, iron, copper, cobalt, and manganese. Iron gave it a pale colour; cobalt and manganese coloured only the cement. In that charged with the cupreous residue of the distillation of acetate of copper, the glass when completely devitrified was of a deep green on the surface, the intensity of which became weaker as it descended towards the centre, where it acquired a reddish shade. A plate of glass coloured with cobalt being placed in the ordinary cement with a capsule of white glass, and exposed to a heat of 50° of Wedgwood, a part of the capsule was found coloured blue, without having suffered fusion; the surface only was eroded and unpolished, which is well explained by the known property of this metallic oxyd to evaporate at a very high degree of heat.

TO BE CONCLUDED IN OUR NEXT.

List of Patents for Inventions, &c.

(Continued from Page 256.)

TIMOTHY SHELDRAKE, of the Strand, Westminster, in the county of Middlesex, Mechanic; for certain wheels, which, when combined together, will constitute a moving power of great force, by the application of which to many engines, machines, and machinery, that are now set in motion by steam, wind, water, or animal power, the effect of the said known powers will be greatly increased, and the labour of men or horses that are now employed on the said engines, machines or machinery, will be diminished; which wheels may be introduced, in part or in the whole, into many engines, machines, or machinery, for whatever uses they may be employed, instead of the wheels and pinions by which such engines, machines, or machinery, are generally kept in motion; and which wheels, when so introduced, will work with much less friction, and much greater velocity, than those which are usually employed. Dated June 15, 1811.

CHARLES HAMOND, of Milk-street, Cheapside, London, Gentleman; for a machine for sawing, cutting, and planing wood. Dated June 27, 1811.

THOMAS ATTWOOD, of Birmingham, Esq. and BENJAMIN COOK, of the same place, Gilt Toy-maker; for a method of combining and connecting together different kinds of metals, and of combining and connecting metals and wood together in such way as to make the combination thereof, whether the same be of metals or of metals and wood, have one appearance or representation only. Dated June 27, 1811.

Sir HOWARD DOUGLAS, of High Wycombe, in the county of Bucks; for an improved circle or semi-circle. Dated July 2, 1811.

RALPH SUTTON, of Birmingham, in the county of Warwick, Brass-founder; for a self-acting curtain or window-blind-rack. Dated July 2, 1811.

ROBERT DAWSON, of Rownham-place, in the parish of Clifton, in the county of Gloucester, Mechanic; for a mode of applying any moving power to machinery, and of increasing such power, and of rendering machinery more easily susceptible of a multiplicity of such powers at the same or different times. Dated July 3, 1811.

JOSEPH BAGNALL, of Walsall, in the county of Stafford, Sadlers' Ironmonger; for a mode of making bridle-bitts, snaffles, and bradoons for horses, and martingale hooks and rings, whereby the leather, or other work belonging to the same, may with much greater convenience be separated therefrom, for the purpose of altering, changing, repairing, or preserving the same, as occasion may require. Dated July 11, 1811.

JOHN TROTTER, of Soho-square, in the county of Middlesex, Esquire; for improvements in the application of steam and other powers to useful purposes, by means of suitable apparatus. Dated July 19, 1811.

CLAUDE COLESTIN MONNOYEUR, of the parish of St. Luke Chelsea, in the county of Middlesex, Gentleman; for a process for the purification of ardent spirits, by which a pure neutral spirit is obtained without rectification or the aid of fire. Dated July 22, 1811.

JOSEPH BADSTONE, of Bridgewater, in the county of Somerset, Cabinet-maker; for improvements applicable

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to bedsteads, and various other things. Dated July 24, 1811.

DONALD CUMMING, of Whitefield, in the county of Northumberland, Farmer; for a machine for reaping and cutting corn and other articles. Dated July 26, 1811.

HENRY JAMES, of Birmingham, in the county of Warwick, Merchant, and JOHN JONES, of Birmingham aforesaid, Gun-Barrel-maker; for improvements in the manufacture of barrels of all description of fire-arms and artillery. Dated July 26, 1811.

MATTHEW JAMES MAYER, of Pentonville, in the county of Middlesex, Mathematical Instrument-maker; for an improved construction of the instantaneous light machine. Dated July 31, 1811.

PETER DURAND, of Hoxton-square, in the county of Middlesex, Merchant; for improvements in, or addition to, lamps, and for rendering the illumination more soft and agreeable to the eye. Communicated to him by a person residing abroad. Dated August 3, 1811.

JOHN ASHLEY, of Homerton, in the county of Middlesex, Plumber; for a filtering vessel, for purifying and cleansing water. Dated August 7, 1811.

THOMAS GILBERT, of Great Yarmouth, in the county of Norfolk, Gentleman; for improvements in machinery for the delivery of bricks, tiles, ornaments, pottery-ware, and other articles made in moulds, after the moulds are filled. Dated August 7, 1811.

HOUSTOWN RIGG BROWN, of Edinburgh, Coach-maker; for improvements in the construction of wheel carriages. Dated August 7, 1811.

WILLIAM

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William Taylor, of Gomersall, in the county of York, Merchant; for a machine or apparatus to be attached to the axletree and nave of wheel carriages, whereby their motion may be gradually checked and stopped, and also again loosened or unstopped, at the pleasure of the driver or passengers during the progress of the carriage. Dated August 7, 1811.

James Mallroy, of the state of New York, one of the united states, now residing in the city of London, Hatter; for a method of making a machine for cutting or shearing the nap or wool from all kinds of broad and narrow cloths. Communicated to him by a person residing abroad. Dated August 7, 1811.

William Davis, of Royal Oak-yard, Bermondsey-street, in the county of Surrey, Engineer; for a machine for chopping meat for sausages, and other like purposes. Dated August 7, 1811.

John Stubbs Jorden, of Birmingham, in the county of Warwick, Patent Copper Window-frame-maker; for a method of glazing hot-houses, green-houses, and all horticultural buildings. Dated August 20, 1811.

William Good, of Coleman-street, in the City of London, Plumber; for improvements in valves for various purposes. Dated September 9, 1811.

Walter Rochfort, of Bishopsgate-street, in the city of London, Grocer and Tea-dealer; for a method of preparing coffee. Dated September 9, 1811.

William Frederick Collard, of Tottenham Court-road, in the county of Middlesex, Musical Instrument-maker; for improvements upon an upright piano-forte. Dated September 9, 1811.

John-

John Barton, of Tufton-street, Westminster, in the county of Middlesex, Engineer; for a sawing machine upon an improved construction. Dated September 9, 1811.

William Walker Jenkins, of Birmingham, in the county of Warwick, Brass-founder; for an improvement in the method of manufacturing drawer and other knobs, of different shapes and forms, used with, or affixed to, cabinet and other furniture and things. Dated September 9, 1811.

John Jones, of Beverton, in the county of Glamorgan, Gentleman; for a method or methods of applying the expansive force or pressure of atmospheric air, condensed air, or steam, in or upon a wheel, so as to be the first mover of machinery. Dated September 9, 1811.

Michael Logan, of Paradise-street, Rotherhithe, in the county of Surrey, Engineer; for an instrument for the generation of fire, and various purposes in chemical and experimental operations. Dated September 9, 1811.

William Strachan, of Porl Cottage, in the county of Chester, Chemist; for a method of preparing the ore of cobalt for the various purposes for which it is applicable in trade, manufacture, and painting. Dated September 9, 1811.

John Chancellor, of Sackville-street, in the city of Dublin, Watch and Clock-maker; for a mechanical instrument on a new construction applicable to clocks and other kinds of machinery. Dated September 9, 1811.

Thomas Marsh, of King-street, in the county of Middlesex, Watch-maker; for certain improvements in the construction of watches. Dated September 9, 1811.

George

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George Kitchen, of Sheffield, in the county of York, Silver Plater; for making portable sconces or branches. Dated September 14, 1811.

Edward Silvester, of Rochester, in the county of Kent, Millwright; for a new drag or skid to be applied to the wheels of carriages of different descriptions. Dated September 14, 1811.

William Fothergill, of Greenfield, in the county of Flint, Copper Forger; for a new method for making copper rollers for printing. Dated September 23, 1811.

Johannes Ambrosius Maas, of Hammersmith, in the county of Middlesex, Gentleman; for his improvement in making of vinegar. Dated September 23, 1811.

James Needham, of Islington Green, in the county of Middlesex, Brewer and Corn Dealer; for a portable apparatus for brewing beer and ale from malt and hops. Dated September 23, 1811.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXIV. SECOND SERIES. Nov. 1811.

Specification of the Patent granted to JOSEPH C. DYER, *of Boston, State of Massachusetts, one of the United States, now residing in London, Merchant; for a Machine for cutting or removing all the various Kinds of Furs which are used in Hat-making from the Skins or Pelts, and for cutting the said Skins or Pelts into Strips or small Pieces.* Dated September 7, 1810.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Joseph C. Dyer do hereby declare that the said invention, and the manner in which the same is to be performed, are described and ascertained in and by the drawings hereunto annexed, and the following description thereof; that is to say:

Fig. 1 (Plate XVII.) represents the machine as seen in perspective, from a point a little in front of, and towards, the right hand side of the end of the machine, where the skins or pelts are introduced to be cut. The letters A A A denote a frame, (of cast-iron, wood, or any other

 suitable

suitable material,) on which the several parts of the machine are adjusted and supported in their operation. In this frame a large (drum-shaped) wheel is hung, to turn freely on its axis *d d*. This wheel, which I call the drum wheel, is composed of two cast-iron, or other metal, wheels, the arms of which are denoted at *c c c*, and which are fastened on the said axis *d d*. On the periphiries of these metal wheels a rim of wood, as denoted at B B B, of about one inch thick, is fitted, and firmly secured by screws or otherwise, and the whole turned true on the axis. This rim B B B is divided into equal spaces on each side round its whole circumference, and grooves cut therein, extending from its opposite sides towards its centre, so as to diverge a little from the line of its axis, and thereby form angles with each other and with the axis of the said wheel. In these grooves the cutters, as denoted at *e e e e*, are bedded and held firm. The number of these cutters will depend on the size of the drum wheel to be used, and the degrees of the angles in which they are required to be set; which last may be left to the judgment of the workmen, after referring to their action in cutting hereafter described; and as respects the size of the drum wheel, although I generally make it about two feet in diameter and fifteen inches wide on its periphiry, in which case it will contain twenty-four cutters, (that is twelve on each side,) yet this size and proportion may be varied without prejudice to the performance of the machine. The width of the said periphiry must, however, be always sufficient to admit the introduction of the skins intended to be cut of their full width. The said cutters *e e e e* should be made of cast (or other fine) steel, about one-eighth of an inch thick, five-eighths wide, and of a length proportioned

portioned to the width of the drum-wheel, so as to extend from the edges to the centre of the periphiry thereof in the determinate angle as aforesaid. These cutters should be fixed in the said wood rim, so as to project out, or stand up, from the smooth surface of the wood, about one-eighth of an inch in the centre of each cutter; and the ends at the centre of the rim should be made to project more than those at the sides, say about one-sixteenth of an inch greater projection at the centre ends.

Fig. 2 is a section, giving a view of those parts of the machine as seen from the front end thereof, where the act of cutting is performed. In this view the rollers denoted at D D are represented as broken off, and a part of them left out, in order to shew the knife E E. This knife is made of a straight plate of steel, ground to a keen edge at the top, through its whole length, which extends across the machine just in front of the drum-wheel, so that its said edge is parallel to the axis of the said wheel. And in order to secure the said knife in its place, so as that it shall be kept steady, and be allowed to move freely backward and forward a little, or approach to, and recede from, the drum-wheel, as is requisite in the act of cutting, it is provided with a frame or support, as seen at F F; which frame is hung in grooves or hollows made to receive its ends in the opposite sides of the great frame A A A, and so disposed as to turn as on a hinge, or to move freely backward and forward a little therein; and the knife being fitted into this frame, (so as to be easily adjusted, or taken out to be ground, &c.) will be held steady, and permitted to approach to, and recede from, the said drum-wheel, as the edges of the cutters on the said wheel are succes-

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sively brought in contact with the edge of the said knife, whilst the wheel is made to revolve in the act of cutting. This straight knife is all the time pressed towards the drum-wheel by the springs T T T, which are adapted to act against its back side, or against the said frame in which it is placed; and there are regulators or stops fitted so as to be easily adjusted on the main frame at each end of the knife, whereby its progress is arrested in its tendency to approach the drum-wheel as it falls off successively from its action againt the edges of the cutters in the said wheel, and it is impelled thereto by the action of the said springs. The ends of the cutters in the drum-wheel (as before described) being made to rise but little above the surface of the wood at each side of said wheel, and to increase in the distance therefrom towards their other ends (at the centre of its periphiry), their edges will thereby be made to fall gently on that of the said straight knife, and to pass freely over it, without any jar or injury to the said edges, as they are successively brought in contact by the revolution of the said wheel. The cutters in the drum-wheel should be placed therein at such distances from each other as to leave a small space between the line (drawn across said wheel) where the straight knife falls off from the end of one of the said cutters at the centre, and that where it meets the opposite or side end of the next knife in succession. It will readily be seen, that as the edges of the said cutters and knife are brought in contact by the revolution of the drum-wheel, they will form acute angles with each other, and being at the same time pressed together (by the action of the springs against the knife as aforesaid), they will cut the said skins or pelts, (when placed between them) on the same principle that the

blades of shears act in cutting. The said feeding rollers denoted at D D, are about one inch in diameter, and of a sufficient length to extend across the end of the machine. They are confined in their proper situation (just in front of the knife E E) by the upright plates at each side of the machine as seen at G G. In these plates there are grooves, which are open at the tops, wherein the ends or pivots of the said rollers are fitted so that they will turn round freely, and not admit any sidewise motion, and so as to permit the said rollers to be taken out at pleasure. These plates consist of two parts, which are secured in their respective places by adjusting screws, and which are so contrived as to permit the said rollers to be placed at a greater or less distance from the said knife, and to have their relative situation regulated and altered at pleasure. The rollers are connected by cogs or wheel-work, so as to revolve together; which cogs, S S, are fitted on the left hand ends of the rollers, outside of the frame. And the said rollers are put in motion by means of the wheel-work, as seen on the right hand side of the machine; that is to say, the wheel *h* is fixed on the end of the axis *d d*, and acting with the wheel *i i*, turns it round, together with its long axis *k k*, and the screw wheel *l*, as made thereon. This last, acting with the wheel *m*, (which is fixed on the pivot of the lower roller), will cause the said wheel, and consequently the rollers D D, to revolve whenever the drum-wheel is turned round. This wheel-work is calculated to produce about one revolution of the feeding rollers whilst the drum-wheel revolves seven times. The feeding rollers are turned true, and then filed (with a coarse file) lengthwise, so as to give a roughness or light fluting on their surfaces, whereby they will take firmly

firmly hold of, and carry the skins forward to the knife when placed between them, and they are pressed together by the actions of the springs *n n*, which are made to press down on the upper roller, and are so contrived as to be opened or raised up at will, to take out the said upper roller. The skin or pelt intended to have the fur cut or removed therefrom must have one end of it placed between the said feeding rollers, (with the fur side downwards), and the drum-wheel being made to revolve (by means of the winch H, or any other first mover), the skin will be advanced towards the drum-wheel, so that its end will be carried just over the edge of the straight knife, where the said cutters in the wheel will meet it as aforesaid, and cut off such part of the skin as shall have advanced beyond the edge of the said knife, and at the same time the fur will be left on the back side of the knife as the skin is thus cut off, and carried away from it by the action of the said cutters against the straight knife. It will be seen, that as the motion of the feeding rollers is very slow, compared with that of the said wheel in which the cutters are placed, the skin will have advanced forward but little on the edge of the knife at each of the successive cuttings thereof, whereby the said skin will be cut into small strips, and these strips will be allowed to fall and pass off from the machine under the said drum-wheel; and that the fur in the mean time which is thus retained on the back side of the knife, will be made to proceed downward, (as the skin advances forward, and is cut off from it,) between the said knife and the feeding rollers. And under these rollers it may be received by any suitable conductor, and carried off from the machine nearly in the same state in which it was disposed on the skins.

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In Fig. 2 the letters *p p p* represent a part of a plate; which is fastened to the knife-frame, and calculated to receive the fur as it descends after being cut from the skins; which plate is curved or bent out so as to guide the fur off, and cause it to fall on a cloth or other conductor, which is fitted to move round on and by means of the roller Q Q, as seen in this figure; which roller is connected by a band, or otherwise with the feeding rollers, and made to move round with them.

In Fig. 1 the letters R R represent this conducting cloth as fixed in a frame T 2 T 2, with a roller at its forward end, round which the said cloth is made to move. But as the fur may be carried off on an inclined plane, or by any other convenient method, I consider the said conductor, which I have described, as not very essential to the principle of the said machine in its operation.

In Fig. 2, L denotes a piece of skin with the fur on it, as they are introduced between the rollers to be cut. The cutters in the drum-wheel should have their projecting edges ground with a short basil, so as to leave on their forward sides the edges blunt, and they should be rubbed with an oil-stone, to make them smooth, which will preserve them from injuring, and render the necessity of grinding or sharpening them (or the edge of the knife with which they act) less frequent.

And I do further declare, that although in erecting my said machines I generally adhere pretty nearly to the size, form, materials, and method of construction as afore described, yet that I do not confine myself to these particulars, as the same may be varied to a considerable degree in many parts without departing from the principles of the said invention, and without injury to the performance of the machine, and perhaps, in-

deed,

deed, to advantage in some cases. For instance, it may sometimes be thought advisable to have the cutters in the drum-wheel made long enough to extend quite across the rim of the said wheel; in which case there will of course be only half the numbers of the said cutters, which, as in those referred to in the drawings, must be set with a proper divergence from the line of the axis to form angles with the straight-knife, of such degrees as may be found to cut to the best advantage. And, I will here observe, that for cutting the fur from very small-sized skins, which will permit the drum-wheel to be made much smaller than the one described, I even use the long cutters in preference to the double range of cutters, terminating in the centre of the rim, as described in the drawings. And instead of the wheel-work, as shewn, to connect the axis of the drum-wheel with that of the feeding roller to give motion thereto, as described, I sometimes obtain the same by means of bands or chains made to run over pullies, wheels, or fuzees, properly adapted to the purpose. But these, as well as many other variations which may be made in the said machine, may be left to the judgment of the workmen, who will find no difficulty in providing for the same so as to adapt its operations to the various kinds of work to the best advantage.

In witness whereof, &c.

Specification of the Patent granted to JOHN FRASER, *Collector of Natural History, now of Sloane-square, Chelsea, in the Parish of St. Luke, in the County of Middlesex; for a Discovery and finding out of certain Vegetables, and a Way of preparing the same, so as they may be usefully employed in the manufacturing of Hats, Bonnets, Chair-bottoms, and Baskets, and for other Articles and Purposes.* Dated October 15, 1810.

TO all to whom these presents shall come, &c. NOW KNOW YE, that the said John Fraser doth, by this instrument in writing, under his hand and seal duly executed, describe and ascertain the nature of his said invention, and the methods by which the same may be performed; that is to say: The said John Fraser collects or gathers the leaves (otherwise called branches) of all or any of the different species of the palm tribe of plants growing spontaneously on the continent and islands of North and South America, and in other parts beyond the seas, but more particularly in tropical climates, and may be there cultivated, and are described in the writings of the celebrated Linneus, and other authors, before the said leaves are of matured growth. And he suspends the same in the air in the shade, in order that they may become well bleached and dry; or otherwise he causes the same to be so collected, bleached, and dried, and in this state he transports them to the place of manufacture. And farther, prepares the same for use by cutting off more or less the outer extremities, where the leaves taper and are thinnest, and from the inner extremities, where the material is most stiff and rigid. And farther, he divides the various portions of the said leaves into longitudinal slips with a knife or

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knives, or other fit cutting tool or tools, used either singly or set in a frame, so as to afford an equal gage for the said longitudinal slips as to the breadth thereof; and he afterwards sorts and selects the said longitudinal slips by separating a part from each other of such slips as are best adapted to the several particular uses in manufacturing as aforesaid. And in some cases he washes the said leaves previous to cutting the same (as before mentioned) with soap and water, and exposes them, after rinsing them, in a moist state to the fumes of burning sulphur in a close chamber or place. And where it may be desirable to dye the said leaves of any particular colour, he performs the same by the usual processes upon them, either in their first state or in any of the subsequent states or stages of manufacture. And farther, that among the different species of the said tribe of plants, the genus *areca* and *corypha* are the most generally useful, and to be prefered; and that the middle portion of the leaf of the plants so cut into proportions as aforesaid, is a better article than that which is produced or afforded by the extremities so cut off. And, lastly, the said slips are and may be usefully employed in manufacturing of hats and bonnets, chair-bottoms and baskets, and for other articles and purposes, by platting, weaving, or intertwining the same with or without the addition or intermixture of silk, wool, cotton, or other fibrous materials, in various well-known manners. And the peculiar strength and flexibility of the said vegetables so prepared do render them capable of being employed in platting or intertextures, which could not be attempted or made with the articles or materials heretofore in use for those purposes.

In witness whereof, &c.

Specification

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Specification of the Patent granted to JOHN PLASKETT, *of Garlick-hill, in the City of London, Stave Merchant, and* SAMUEL BROWN, *of Norfolk-street, Southwark, in the County of Surrey, Cooper; for a Method for the making or manufacturing of Casks and other Vessels by improved Machinery, which said Machinery is applicable to other useful Purposes.*

Dated March 6, 1811.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said John Plaskett and Samuel Brown do hereby declare that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say:

First. We do saw out the planking for the staves of casks in the usual manner, or otherwise we do make use of a circular saw for that purpose; and we do cut the said staves or pieces into fit or suitable lengths for making the intended cask.

Secondly. We do provide machinery for cutting the edges of the said staves either straight or curved, according to the figure of the cask intended to be made, which may be cylindrical or conical, or spheroidal. And the said machinery doth consist of a strong bench, having a board or platform to be slided or moved endwise thereon. And upon the said board there is placed another piece, capable of being slided crosswise. Which last-mentioned piece hath a recess or hollowed part into which the stave-board may be laid, so that one edge of the stave-board may and shall project clear be-

... board or platform first mentioned ... distance of such projecting ... piece before described ... capable of sliding crosswise. And in order that the quantity of the last-mentioned cross motion may be ... and readily effected and adjusted, we do ... the same by a couple of racks and pinions, or ... work and a handle, or by joints similar to those commonly used in parallel rollers. And farther, we do fix above or beneath the said bench a circular saw, revolving on the axis nearly at right angles to the direction in which the first-mentioned board or platform can be slided or moved as aforesaid, and opposed to the course or direction of the said motion of the projecting part of the said stave-board. And the said circular saw is to be made flat when straight-edged staves are to be cut, ... to be made of a dish or globular figure, to coincide ... agree (or nearly so) with the circular or curve line ... curve-edged staves are intended to be cut. And ... with regard to the sliding or moving endwise ... said board or platform first mentioned, we do ... the same either in right lines (and in that case ... said board or platform hath its motion confined be... straight sliders or grooves); or else we do perform ... circular or curved lines, and in that case ... board or platform hath its motion confined by ... curved sliders or grooves ... or otherwise ... sliders or grooves, we do make use of ... moving against pins, according to ... and well-known methods for producing ... curved motions in machinery. And ... of the said staves, we do place ... hereinbefore described, and ...

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ne same onwards, by the means aforesaid, so as to ome up to, and pass, the edge of the saw, which is to e then in motion, and will cut the intended line along he edge of the stave, so as to give a duly sloped face o the said edge suitable for constructing a cask. And in the said operation care must be taken in turning the stave edge for edge, that the same surface of the stave-board shall in both cases be downwards.

Thirdly. We do make use of machinery for cutting the nose or projecting part in the bung-stave of small casks, called bottles; which machinery doth consist of a flat or a concave circular saw to be employed for cutting the face of the stave close up to the said nose or projecting part, accordingly as the said face is required to be flat or curved; in which last case the said stave must be moved upon a convex or slightly spherical bed. And the said machinery doth also consist of another circular saw, duly placed on its arbor, to revolve nearly at right angles to the plane of the other circular saw, and to be employed in making the cut close to the said nose or projecting part. And after the two faces on each side of the nose have been duly so formed, we do perforate the bung-hole by means of a bit, which we fix at the opposite end of the arbor belonging to the last-mentioned circular saw.

Fourthly. We do set or put up the said staves so as to form a cask in the usual manner, connected by truss hoops.

Fifthly. We do fix the said cask in a stout flat piece of wood, or other fit material, called the chuck, having a circular hole therein, of the proper size to fit and be driven upon the end of the said cask; and the chuck in this situation retains the cask firmly, having the axis thereof

thereof concentric with the chuck, and at right angles to the flat face of the same.

Sixthly. We do construct a cylindrical cage, or hollow implement, of sufficient size and strength to hold a cask therein: and we do firmly fix the said cage upon a strong upright arbor, revolving between collars, and serving the office of the mandril of a lathe: and the upper part or edge of the said cage is turned true and fair, and two studs or pins project therefrom, which are fitted and adapted to two holes in the face of the before-described chuck, so that when the chuck is duly placed with the said pins in the holes thereof, the face of the chuck shall fairly apply to the face of the cage, and the axis of the cask, which will then be in the cage no otherwise supported than by the chuck itself, will be in the same line with the axis of the arbor. In this situation we turn and finish the chime and groove for receiving the head by the application of a turning tool or tools, duly fashioned for that purpose at the edge or cutting part thereof. And we do make use of a rest for the tool upon or by the same principle or mode of operation as is used or adopted in other processes of turning. And, moreover, in finishing the chimes of small casks we do chuck, suspend, or support the same, where needful or to be preferred, by an arbor and cage, or hollow implement, revolving round an horizontal line or axis instead of a vertical one.

Seventhly. We do construct and make the heads of our casks out of pieces wherein the holes for receiving the pegs or pins are bored by a bit or piercer proceeding from a mandril. And the said pieces of wood brought up to the said bit or piercer upon a bearing gage piece, by which the distances of each of the

holes from the face of the board and from each other are correctly regulated: and we do pin the head together as usual.

Eighthly. We do place the said head, pinned together, upon a flat revolving table or piece, having small points proceeding therefrom. And we do secure the same in its place by the counter pressure of another flat piece, which is to be screwed against it, but so held on its centre as to be capable of freely revolving: and in this situation we do apply any fit tool or tools to turn and shape the circumference of the said head to its proper size and figure.

Ninthly. We do put the cask, when entirely connected together with the heads in their places, between the centres of machinery of the nature of a strong lathe; and for this purpose we do stick a small steel centre piece in the middle of one of the heads for the purpose of receiving the centre from the moveable poppet head, or piece serving for that purpose. And we do also apply against the other head another stout piece of wood, or other material, to fit into the chime, and attach itself to the head by points: and in the centre of the said stout piece we do fix a steel piece to receive or be applied to the centre or point proceeding from the nose of the mandril. And we do connect the said mandril with the said stout piece so that the cask may be carried round in turning by a throw chuck and dog, or by a projecting piece and pin, or any other contrivance well known to turners; and into the said lathe we do fix a bar, or rod, or wire, to serve partly in the manner of a rest. To this bar, or rod, or wire, we do apply, annex, or append, by a sufficiently long arm or arms, a spoke-shave, or other fit instrument. And we do apply the

the said spoke-shave or instrument to the surface of the cask, and do thereby finish and complete the same.

Tenthly. We do bend wooden hoops in a more compleat and expeditious manner by applying the same in such a manner as to fasten one extremity thereof to the surface of a wheel, which being turned round, and the remaining part of the hoop pressed against the circumference thereof, the hoops receive the regular bend with great correctness and expedition.

And, lastly, we do declare, that in giving motion to all the said machinery, and in constructing, connecting, and using the same, we do avail ourselves of the usual first movers or powers, and such mill-work and other mechanical connections as the local circumstances and purposes to be obtained shall or may require; but that the same not being peculiar to our said invention, but common and necessary to all operative processes, and well known to all competent workmen, we do not consider it as incumbent upon us to point out or describe any of the said powers, works, and connections.

In witness whereof, &c.

Specification of the Patent granted to William Bundy, *of Camden Town, in the County of Middlesex, Mathematical Instrument-maker; for an Improvement on stringed Musical Instruments.*

Dated April 24, 1811.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said William Bundy do hereby declare that my said invention is fully described in manner following; that

that is to say: To produce the most powerful sound by the vibration of strings, it is necessary the materials such strings are composed of should be of the greatest specific gravity and elasticity; therefore the strings for piano fortes, and all other musical instruments which are required to be metallic, will be improved in proportion to the quantity of those requisites applied to compose such strings. The material which has been in general used for strings of the upper notes particularly, being of the greatest elasticity, combined with strength, only requires an increase of specific gravity to improve them, which may be effected by entwining or covering with a metal, or composition of metals, drawn into wire, whose specific gravity is considerably more than that of the covered strings; for this purpose gold will apply well; but I use platina (being of the greatest specific gravity) to increase the power of vibration. The application and mode of combining or connecting it with any other metal or material which may be used to form a string I claim as my invention, and call such application a philosophical improvement. In the use of this heavy metal, platina, I find the purity and power of tone is increased with the quantity used, and that the strength of the string covered, whether brass, steel, iron, or any other metal or material, must determine the quantity; for if too much platina be added, the string will not stand drawing up to its proper tension. The note F and F✱ in the bass, whose length may be fifty-seven and fifty-six inches from guide-pin to bridge-pin, made of brass wire, one foot of which weighs fifteen grains and a half, will carry twenty-four rounds of platina wire entwined on each inch, drawn to one inch and a quarter,

one grain weight. The sizes of wire, for the following notes are to decrease uniformly, so that the wire of the following note G, weighing 13 grains each foot, will carry covering platina wire of ¾ of an inch the grain weight; the G above weighing 11 grains will carry platina wire of 2 inches the grain; the G above weighing 9½ grains will carry platina wire of 3 inch the grain; the G above weighing 7½ grains will carry platina wire of 4½ inches the grain; the G above weighing 7 grains will carry platina wire of 5 inches the grain; the G above six grains will carry platina wire of 6 inches the grain; covered or spun twelve rounds on each inch of string. To fix the platina wire on the covered strings so firmly as to withstand the agitation while vibrating without disturbing the intimate connection of the different metals, and preserve the vibration from being clogged by continuing the covering (which has hitherto been practised) beyond the pins, I make the covered wire rough, by drawing a sharp bastard-cut file along the wire several times, which prepares the string to receive the covering platina wire whose ductile nature admits of being forced by pressure (while spinning or covering) into the indents made by the file, and renders it perfectly secure, though the ends terminate within the pins.

This method I claim as my invention, for securing the covering of strings with wire of any ductile metal, or composition of metal, whose ends of covering are secured and terminate within the guide-pin and bridge-pin. Strings made of animal substance, as gut or silk, have their power of vibration much increased by being covered with platina wire, instead of wire of inferior

ferior specific gravity, though the weight of the metal covering be equal, from the advantage of its decreased bulk compared with other metals. And as some difficulty may arise in drawing the platina wire so fine as will be required to cover close on the string, I use platina wire, drawn to six inches and a half *per* grain weight, to cover the fourth string of a violin, making 100 revolutions on each inch of string; and if an additional string be required to the violin, a fifth may be put to follow the fourth, with great advantage, by covering gut, the size of a second string, with platina wire, of four inches *per* grain weight laid close on the string; and an improved third string may also be obtained by covering gut, the size of a full first string, with platina wire, of six inches and a half *per* grain weight, with sixty rounds on each inch of string. The strings for a tenor violoncello, double bass harp, and all other instruments whose strings are composed of animal substance, are improved by covering with platina wire, giving the same weight as is now in use of common metal wire to covered strings, which I claim as my invention.

In witness whereof, &c.

Observations by the Patentee.

An advantage the publick may derive from this Patent is, that those strings may be applied to any description of piano-forte already in use, as no alteration of the scale is necessary to receive the improvement.

Remarks on the Construction of Iron Bridges, particularly on that intended to be erected over the Thames from Bankside to Queen-street, in the City of London, to be called The Southwark Bridge. *By* J. W. B.

Communicated in a Letter to the Editors.

With a Plate.

GENTLEMEN,

I HAVE perused with satisfaction the account given in the CXth Number of the Repertory, of the proposed iron bridge over the Thames, opposite to Queen-street, Cheapside, and observing that the public mind seems inclined to encourage these kind of structures, I beg leave to offer a few remarks on that subject generally.

It is now many years since the first iron bridge was erected at Colebrook Dale, yet (speaking comparatively with the series of ages during which stone bridges and wooden bridges have been built) the art of building iron bridges is still in its infancy; but it is like the infancy of Hercules, and has started at once into estimation and fame: and though the serpents of envy and prejudice have endeavoured to destroy it in its cradle, it has now nearly vanquished them, and the faint hissings which they still send forth are rather tokens of their weakness and subjugation than menaces in any way formidable.

But, returning to plain matter of fact, I believe few instances can be exhibited of an art which, in an equal period of time, has been so uniformly successful. Of the number of arches of iron framing which have been erected, only one [Staines Bridge] I believe has fallen, and this in circumstances rather to prove its superiority than to depreciate it, for the iron-work did not give way till

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the stone abutments first yielded; the fault therefore was in the construction of the abutments, and not in the iron framing. But I do not mean to say that iron bridges cannot be as improperly constructed as many stone ones have been, and may consequently fall. And in the same period how many instances of stone arches having given way might be cited? Autumnal and ice floods hardly ever occur without numerous presentments on this very account; nay, whole bridges of great extent and massy masonry have been utterly swept away in the same number of years, that only exhibits one solitary instance of the failure of an iron arch, and in the excusable circumstances mentioned.

There are no works of art in existence which have the united testimony of so many eminent mathematicians and engineers in their favour as iron bridges; and this given in the most unequivocal, circumstantial, and public manner; as is evident from the reports of Dr. Hutton, Dr. Maskelyne, Professors Robertson, Playfair, and Robison, Mr. Watt, Mr. Rennie, Mr. Jessop, and of many other gentlemen of acknowledged abilities and science, which were printed by order of the House of Commons in 1801, and fully prove the propriety of adopting them. Why then should any doubts remain? None do remain with men of science, but dwell with the ignorant, from their vanity and fearfulness; who, like children in the dark, are ever dreading spectres, that have no existence but in their own imaginations; and, though conscious of their own inability, will ever be the foremost to give opinions on, and meddle with subjects of which they not only have no knowledge, but are perhaps incapable of comprehending.

Fusible iron, as a material for bridges, has many advantages over stone or wood. It is superior to the first in tenacity and elasticity; and from thence in strength, in the facility of formation, and in the extent of the masses in which it can be exhibited; all which make it superior in lightness and cheapness. To wood it is superior in all the same particulars, and in that of durability besides; in which respect alone it is inferior to stone.

The greater durability of stone arises, in the first instance, from its being less acted on by the weather; and, in the second, from its experiencing less vibration from the motion of carriages on account of the great masses in which it is used. But there are several ways of guarding against the deficiency of iron in these respects; paint will prevent corrosion from rust for many years: and instances could be shewn, where cast-iron carriages of garrison guns have been preserved thus, in an unimpaired state, from the time of the last king William: and the vibration can be greatly diminished, if not totally prevented, by the use of triangular framing throughout, and by putting sheet-lead between the joints of the frames. But it is probable both evils might be prevented more effectually by the mode proposed by the late Mr. Samuel Wyatt to the House of Commons, of filling the vacancies between the iron frames with some compact cheap material: and none would be more effectual for this purpose, or perhaps cheaper in the end, than brick cemented by Roman cement, or pozzolana, or tarras, which, owing its binding nature chiefly to iron oxyd, would unite to the iron of the bridge in the closest manner, and defend it from every access of air, while the increased mass that would be thus produced would annihilate vibration, or reduce it to an imperceptible quantity.

city. But as lightness is a desirable quality in these bridges, perhaps it might be advisable to form hollow bricks purposely for this use; which, on account of the more compleat baking or burning in the kiln, of which they would be capable, would perhaps be equally durable as any stone. As a proof of which opinion, the thin bricks used by the Romans are still in perfect preservation in many places. Filling up the intervals of the iron bars would also have the advantage of preventing almost entirely their expansion and contraction from change of temperature.

Iron may be used for bridges either on the principle of equilibration, as stone is, or on that of connection by framing, as wood is in some bridges, but more generally in roofs. For large bridges the first is preferable, according to the best opinions; but probably the latter mode would be found cheaper for small bridges. There has been one specimen of a wooden bridge built on a very different system from others, (of which many models are preserved, though the French have destroyed the original,) that seems worthy of being imitated in iron, on a greater scale, which is the bridge of such curious structure that stood so many years at Schafhausen: and it is probable if the model was studied with this view by an experienced engineer, many useful ideas might be obtained on the subject.

The greater flatness of the arch, which iron admits of, is an advantage it has over stone, which should not be omitted. It is capable of demonstration, (and has indeed been proved *, in a treatise on roads and wheel-carriages, presented to the House of Commons, and

* See J. W. Boswell's Paper on Roads and Wheel-carriage, inserted in Vol. XVII. p. 13.

printed

printed by their order, which has been inserted in this work,) that every increase of ascent in a road adds to the expense of conveying goods over it in a degree much greater than has been suspected. A lofty arch has in this respect all the disadvantage of a high hill, while a flat arch either affords a level road, or one nearly so; and this quality is peculiarly desirable for a bridge in London, over which, from the immense trade of this metropolis, so many and such heavy loads may be expected to be conveyed. The plan of the Southwark bridge has a great advantage in this respect; for, from having three arches, it is capable of much greater flatness than any of those which were formerly proposed to be constructed with one arch near the same place, even if that arch had sprung close to the water at each side.

The difficulty of preparing centering for the large arches (the capability of producing which is one of the great advantages of the art of framing iron bridges) is now in a great measure removed, by the ingenious mode proposed for this purpose by Mr. Telford, in his report to the House of Commons on the proposed bridge over the Menai. The idea of supporting centres in this way has not before been generally under consideration; and the various modes in which it may be applied are yet to be investigated. Several of this nature have occurred to the writer of this article, some of which apply to the centering between piers. An account of them, with Mr. Telford's, will be offered in a future number of this work.

It will occur, in comparing the estimates of the Menai bridge with those for that of Southwark, that though the former require considerably more materials and workmanship,

manship, yet the amount is less. But this appears to be accounted for sufficiently by what Mr. Rennie observed, in his report to the House of Commons in 1801, on the subject of erecting an iron bridge, of a single arch, in place of London bridge, which was in the following words: "The price of labour and of all kinds of materials in London is so high, the ground which can be procured for laying materials and working them so limited and expensive, that no person unacquainted with these circumstances can appreciate the cost, which, I think, is stated too low in the estimate of that proposed by Messrs. Telford and Douglass."

The extracts from the reports relative to London bridge, given in this publication for July last, shew the absolute necessity of providing a safe passage over the Thames to that part of the Borough to which it extends, in place of that tottering, cracked, and undermined structure, which is a disgrace to the nation, and a perpetual reproach to the Corporation, for continuing an edifice which occasions to the river and the trade thereof such incessant and enormous injury. The inhumanity, in suffering an artificial Charybdis to remain in the heart of London, in whose destructive cataracts the lives of thirty or forty of their fellow citizens, and property to the amount of 40,000*l.* have been proved to perish annually, is no trifling disgrace to an enlightened city; and all this, while the very sum spent in nominally repairing the bridge, but in reality in adding to the obstructions and dangers it already occasions, would go a great way towards paying the interest of the sum necessary to build a safe, creditable, and beautiful communication, whereby all these existing evils would be entirely removed. And if the city be not rich enough to spare

 the

the necessary sum for rebuilding it, a very moderate toll for two, or three years at most, would produce it.

Yours, &c.

J. W. B.

The Editors have subjoined to this communication an elevation of the proposed Southwark bridge, (see Plate XVIII.) in order that the publick may form an opinion of the additional conveniencies and ornament which it will give to the metropolis, and with what facility the great mischiefs of London bridge might be removed by a similar structure on that site; or, as the river is about 236 feet wider at London bridge, perhaps five arches might be preferable to three.

Description of two Implements for cutting Leather Straps for Sadlers, Harness and Collar Makers, &c.

By Mr. Lewis Aubrey, *of Fort-place, Bermondsey.*

With Engravings.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

THIRTY guineas were voted for this invention, and certificates were received from the following persons, addressed to Mr. Aubrey, dated in March last.

From Mr. W. B. Brown, of Two Waters Mill, stating that it is with much pleasure he has it in his power to bear full testimony to the superiority of the deakle straps cut by his process, as they combine those indispensable qualities of regularity in thickness and breadth, so particularly requisite for their purpose.

From

Pl. XVII. Vol. XIX. Second Seri

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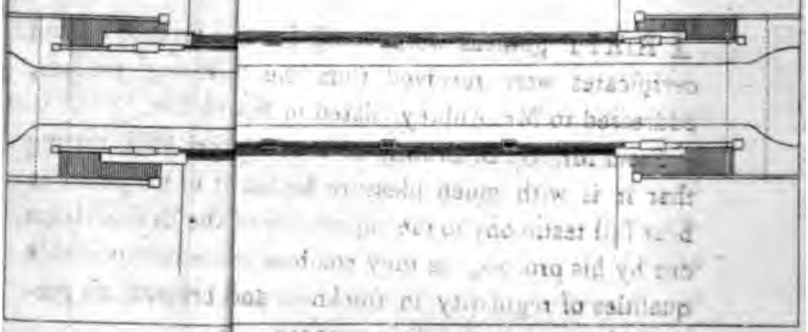


Bridge.

From Mr. John Buttonshaw, of West Peckham, Kent, stating that the deakle-straps and wire-straps used in his machine for manufacturing paper, are made perfectly smooth and true, and much superior to any he can get made either at the shoe or collar makers, or any other workers of leather, and that he buys them of Mr. Donkin, Fort-place, Bermondsey.

From Mr James Swann, of Ensham Mills, near Oxford, stating, that in answer to Mr. Aubrey's letter, he can readily certify, that the straps lately supplied by Mr. Donkin, and which are made with tools of Mr. Aubrey's invention, are found to be superior in point of evenness, width, and thickness, to any he ever procured before, and which have induced him a few days ago to order a farther supply of them.

From Mr. Richard Elliot, of Chesham, stating, that at Mr. Aubrey's request, he would say what he knew from practice respecting the leather cut by his machine; that they are the best he ever had, and are cut as correct as possible, both in thickness and width, and answer much better than any cut in the common way.

Reference to the Engravings.

Figs. 1, 2, and 3, (Plate XVII.) are a plan, section, and end view of the instrument for cutting leather straps to an equal thickness. A is the knife fixed to the frame by two screws *a a*, which pass through holes in the end of the knife, and have two nuts upon each of them, between which is fastened the knife, and by means of these the knife can be raised or lowered, and fixed at any

point, by screwing the nuts towards each other. *b*, Fig. 3, is the lower, and *c* the upper one, which fastens the knife upon the other; the screws *a a* are fastened to the frame by two plates and four screws at *d d d d*, which fit into oblong holes in the plates, and can be loosened to put the knife nearer to, or farther from, a roller B, between which, and another roller D, Fig. 2, (concealed in the wooden frame,) the leather strap passes; the bearing *e e* for the pivots of the upper roller are screws, and received into tubes E E, Figs. 1, 2, and 3, which are also screwed internally, so that by turning these tubes round, the roller is brought nearer to, or farther from, the roller D, to suit straps of different thicknesses; the tubes are also drawn down by helical-springs (concealed in the wood), which keep the upper roller down with a moderate pressure, but at the same time allow it to rise up if a thick part of the strap comes under it. F F are two handles fixed to the mahogany block, which is the frame for the whole. G is a rod of wire bent at right angles at each end, and driven into the block with two sliding pieces *g g* upon it, which can be fixed at any distance from each other by screws; these are set to the width of the strap to keep it parallel in passing through the rollers B and D; it enters in between them, passing under the knife A, and over the inclined part *h*, Fig. 2; the end which is just through is fastened to the work-bench, and the workman takes the machine by its handles F F, and draws it back from the bench; this pulls the strap through between the rollers, and the knife removes all the leather which projects above its edge, leaving the strap of a perfectly equal thickness throughout; this thickness is, as above mentioned, regulated by the distance; the knife edge is placed above the roller D:

[redacted]

Pl. XVII. Vol. XIX. Second Series.

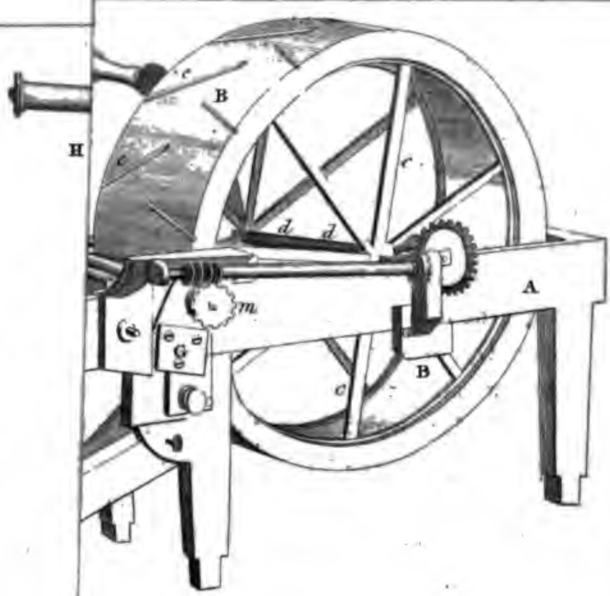
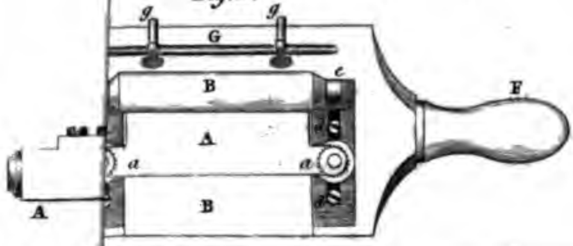


Fig. 1.



[redacted]

D: in cutting the strap the smoothest side is placed downwards upon the lower roller.

Figs. 4 and 5 (Plate XVII.) are elevations of the other machine, for cutting the strap to an equal width throughout. A A is a brass bar, made hollow for lightness. B B an iron frame screwed to it, and supporting a frame D, containing a roller E. The frame D slides up and down in the other by a screw and nut *a*, but it has a constant tendency towards the bar A by means of a spring *b*, which surrounds the screw, and counteracts the pressure of the nut *a*. F is a piece of the brass sliding upon the bar A, and can be fixed at any part of it by the screw C; it has a semi-circular gap cut in it to admit the roller E, as shewn in Fig. 5. *g* is a small and thin sharp-edged knife, put through the end of the bar A, and held in its place by a screw *d*. This knife is placed exactly at the end of the roller, as seen in Fig. 4. The strap to be cut is passed through the opening *e*, Fig. 4, and the roller suffered to descend by its nut *a* until the spring presses the roller down upon the strap with sufficient force to keep it steady. The piece F is fixed along the bar at the same distance from the knife as the strap is intended to be wide; and this is shewn by the divisions on the bar, the strap being then drawn through under the roller, the knife cuts away all parts which are beyond its edge, and reduces the strap to the proper

On Irrigation. By Mr. Edward Beck, *of West Lexham, in the County of Norfolk.*

From the Communications to the Board of Agriculture.

THE bad state of the lands induced me to improve them by irrigation; they were not worth five shillings *per* acre in their original state. They were executed under the direction of Mr. W. Smith; the expense *per* acre 30*l.*

I begin to water them the latter end of October, and continue the watering till February; then if any fine days, the water is taken off, and put on again in the evening: indeed the principle is, that whenever the air is warmer than the water the latter is taken off. I begin feeding them about the 10th of March quite close, then water them again, and feed them till about the 10th of May, when they are (after being watered two or three days) shut up for mowing in six or seven weeks. They produce, on an average, two tons and a half of good hay *per* acre. After the hay is off they are watered again, and fed with fatting sheep, cows, and young cattle: I do not put on any other than fatting sheep, as there is no doubt of their rotting if watered after the hay is off; but in feeding them in the spring they are perfectly safe, and very healthy for sheep of every description. The hay is good for cows, producing much milk. I have fed my breeding ewes with it frequently, and they do well, which enables me to manure my arable land to much advantage. I calculate that an acre of water meadow produces in every way manure sufficient for an acre of arable.

arable. To the queries respecting the rent or *per* centage of land thus improved, I find some difficulty in answering, as there may be local circumstances intervene to make them of more or less value: for instance, if mine were situated in the vicinity of London, they would be of much more value, and of less if I had a proportion of pasture land on my farm, or if my arable land required less manure; but after my experience of the convenience as well as of the profit, I would readily give a rent of five guineas *per* acre rather than be without them. As to the *per* centage, I should hope no gentleman would wish for more than a net five *per cent.* for his money in the first instance; because, I do think, that the turn of the scale should be given to the tenant for the first lease. I must here take leave to observe, that upon the plan of five *per cent.* and a twenty-one year's lease, I am of opinion, that many hundreds, I may say thousands, of acres would soon be irrigated in this county. I shall not attempt any thing like panegyric on my best of landlords, but merely state, that he not only gave me a twenty-one year's lease, but renewed it after I had completed my meadows, and seven years of the original lease had expired after this, and every other encouragement that could be given to a tenant. I hope it will not be too much for me to say, that if Mr. Coke's example as a landlord was followed, this county would soon, comparatively speaking, become a garden. To the remaining queries, as to the importance of irrigation to Norfolk, and how many acres would be so improved:—To the first, I have no hesitation in saying, it is of the first importance, and by far the most valuable improvement that has been introduced in this county. As to the latter, I cannot speak with any

any degree of certainty, but I should suppose many thousands of acres; certainly there is no county in the kingdom where meadow land is less improved, nor any where it is more wanted.

My thrashing-mill was made by Mr. Cook, of Swanton Abbots, Norfolk. It thrashes every kind of grain well, and separates the corn from the straw; it is worked with four horses; cost 125 guineas: I have had it three years; it has never been materially out of order, nor cost twenty shillings repairing since I have had it. There is no doubt of its being the best and most useful of any yet erected in this county.

St. John Priest, Secretary to the Norfolk Agricultural Society, and Levi Walton, Assistant to the Rev. St. John Priest, in surveying and delineating the water meadows at Lexham, certified that Mr. Edward Beck did, in the last year, irrigate in the county of Norfolk, where irrigation is not in general practice, at least sixteen acres of land, which in its original state was an entire bog, and but little of it valuable for any purpose but cutting turf to burn: the cost of which was thirty-five pounds *per* acre. This was begun in March, 1807, and from its boggy state did not produce any feed, but was covered with rushes. By taking off the springs the land is now become solid, and promises a good Spring feed, and a crop of hay of good quality. The greater part of this is laid into parallel beds, with about two feet fall, having the floating gutters upon the crowns of the beds; the remainder is catch-work, watered by springs which rise in the meadow, and in the original state of it rendered useless.

On

On Irrigation. *By Mr.* THOMAS PURDY, *of Castle Acre, in the County of Norfolk.*

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

AS I am now watering at least twenty acres, in a most complete manner, by forming them into beds of from ten to twolve yards breadth, and introducing the water upon the crowns of the beds, to be carried off by parallel drains, I desire to state, that the meadows I am irrigating are situated in a neighbourhood which consists almost entirely of arable land, let generally for not more than from ten to eighteen shillings *per* acre *per annum.*

That meadow and pasture land do not bear a greater proportion than of one acre to fifty of arable land, and that notwithstanding this great want of feeding land, yet the meadows which I am irrigating were not in their old previous state worth more than seven shillings *per* acre to let, being two-thirds of it boggy, and the remainder full of sedges and all sorts of aquatic rubbish.

In the present state, and with the prospect of future advantages to be gained by this irrigation, a neighbouring farmer has already offered me to hire the whole of these meadows for any length of time, and to give me for such hire five guineas *per* acre *per annum,* not doubting but they will produce in the first crop of hay next summer at least two tons and a half *per* acre.

The method I have taken to irrigate the above meadows is, by taking water out of its natural course, at the

distance of at least thirteen chains above my first meadow, by a ditch, upon the average twenty feet wide, seven feet perpendicularly deep, and six feet wide at the bottom. The water thus introduced, divides itself into two feeders, one of which conveys water to my first meadow, and then runs off to water my last meadow; and the other to the other intermediate meadows. All the meadows are formed into beds, as I have stated above, which are raised so as to have a fall on each side from two to three feet, and so well formed, as to be watered in every part. The work is all done by labourers with spades, and will cost altogether about 30*l.* *per* acre. This expense, however, I think by no means considerable, when I take into consideration the circumstances of value above stated, and when I consider, what perhaps may not occur in those countries where irrigation is more practised, *viz.* that the turnip crop, as food in winter, is becoming more expensive and (what is of great consequence) more precarious; to supply which deficiency, I expect the hay of these water meadows to be such a resource as is almost inestimable.

The Rev. St. John Priest, Mr. Hendle, and Mr. Kitbell, certified the truth of the above account.

[redacted]

On Potatoes.

By Thomas Andrew Knight, *Esq. F. R. S. &c.*

From the Transactions of the Horticultural Society of London.

In the Horticultural Transactions of 1807 I have described a method of cultivating early varieties of the potatoe, by which any of those which do not usually blossom may be made to produce seeds, and thus afford the means of obtaining many other early varieties. I also offered a conjecture that varieties of moderately early habits, and luxuriant growth, might be formed, which would be found well adapted to field-culture, and be ready to be taken from the soil in the end of August or the beginning of September, so that the farmer might be allowed ample time to prepare the same ground for a crop of wheat. I am now enabled to state, that the success of the experiment has in both cases fully answered every expectation that I had formed.

The facts that I have stated in the Horticultural Transactions of 1807, and more fully in the Philosophical Transactions, are, I believe, sufficient to prove that the same fluid or sap gives existence alike to the tuber, and the blossom and seeds; and that whenever a plant of the potatoe affords either seeds or blossoms, a diminution of the crop of tubers, or an increased expenditure of the richness of the soil, must necessarily take place. It has also been proved by others, as well as myself, that the crop of tubers is increased by destroying the fruit stalks and immature blossoms as soon as they appear, and I therefore conceived that considerable advantages would arise if varieties of sufficiently

luxuriant growth, and large produce, for general culture, could be formed, which would never produce blossoms.

I have since had the gratification to find that such are readily obtained by the means which I have detailed, and I am disposed to annex more importance to the improvement of our most useful plants, than any writer on agriculture has hitherto done; because whatever increased value is thus added to the produce of the soil, is obtained without any increased expense or labour, and therefore is just so much added to individual and national wealth.

I formerly supposed that all varieties of the potatoe which ripened early in the autumn, would necessarily vegetate early in the ensuing spring, and could therefore be fit for use only during winter; but I have found that the habit of acquiring maturity early in the autumn is by no means necessarily connected with the habit of vegetating early in the spring; and therefore, by a proper selection of varieties, the season of planting crops for all purposes may be extended from the beginning of March nearly to the middle of May, and each variety be committed to the soil exactly at the most advantageous period.

A variety, however, which does not vegetate till late in the spring, and which ripens early in the autumn, cannot, I conclude, particularly in dry soils and seasons, afford so large a produce as one which vegetates more early: I, nevertheless, obtained so large a crop from one which vegetates remarkably late in the spring, and ripens rather early in the autumn, that I was induced to ascertain, by weighing, to what the produce would have amounted had the crop extended over an acre, and I found

found that it would have exceeded 21 tons, 11 cwt. 80 lb. *.

In this calculation the external rows, which derived superior advantage from air and light, were excluded; and no more manure or culture than is usually given had been employed; for the crop was not planted with any intention of having it weighed: the wet summer was, however, very favourable.

I am not acquainted with the common amount of the weight of a good crop of potatoes, upon an acre of ground in a favourable soil, when well manured and cultivated; but, I am confident, that it may generally be made to exceed twenty tons, by a proper selection of varieties: and if four pounds of good potatoes afford, as is generally supposed, at least as much nutriment as one pound of wheat, the produce of an acre of potatoes, such as I have described, is capable of supporting as large a population as eight acres of wheat, admitting the calculation of Mr. Arthur Young, that the average produce of an acre of wheat is 22½ bushels †: and as an acre of wheat will certainly support as large a number of people as five acres of permanent pasture, it follows that an acre of potatoes affords as much food for mankind as forty acres of permanent pasture: an important subject for consideration in a country where provisions are scarce and dear, and where so high bounties on pasture are paid in the form of taxes on tillage, that the extent of permanent pasture is certainly and consequently increasing: and it must increase, under existing circumstances; for it pays a higher rent to the landlord, and relieves the farmer from much labour, anxiety, and vexation.

* 48352 lbs.

† 1440 lbs.

To

To what extent a crop of potatoes will generally be increased by the total prevention of all disposition to blossom, the soil and variety being, in all other respects, the same, it is difficult to conjecture; but I imagine that the expenditure of sap in the production of fruit stalks and blossoms alone would be sufficient to occasion an addition of at least an ounce to the weight of the tubers of each plant: and if each square yard were to contain eight plants, as in the crop I have mentioned, the increased produce of an acre would considerably exceed a ton, and of course be sufficient in almost all cases to pay the rent of the ground.

I do not know how far other parts of England are well supplied with good varieties of potatoes; but those cultivated in this part of the island are generally very bad. Many of them have been introduced from Ireland, and to that climate they are probably well adapted; for the Irish planter is secure from frost from the end of April nearly to the end of November: but in England the potatoe is never safe from frost till near the end of May; indeed, I have seen the leaves and stems of a crop, in a very low situation, completely destroyed as late as the thirteenth of June; and they are generally injured before the middle, and sometimes in the first week of September.

The Irish varieties, being excessively late, are almost always killed by the frost whilst in full blossom; when omitting all consideration of the useless expenditure of manure, it may justly be questioned whether the tubers of such plants, being immature, can afford as nutritive, or as wholesome food, as others which have acquired a state of perfect maturity.

The

The preceding statement will, I trust, point out to the Horticultural Society the importance of obtaining improved varieties of the potatoe, and I believe no plant existing to be more extensively capable of improvement relatively to the climate of England; and if practical evidence were wanted to prove the extent to which the culture of the potatoe is calculated to increase and support the population of a country, Ireland most amply affords it; where population has increased amongst the Catholic poor, with almost unprecedented rapidity, within the last twenty years, under the pressure of more distress and misery than has perhaps been felt in any other spot in Europe.

I shall conclude my present communication with some remarks upon the origin and cure of a disease, the *curl*, which a few years ago destroyed many of our best varieties of the potatoe; and to the attacks of which every good variety of the potatoe will probably be subject.

I observed that the leaves of several kinds of potatoes, which were dry and farinaceous, that I cultivated, produced curled leaves, whilst those of other kinds, which were soft and aqueous, were perfectly well formed; whence I was led to suspect, that the disease originated in the preternatural inspissated state of the sap in the dry and farinaceous varieties. I conceived that the sap, if not sufficiently fluid, might stagnate in, and close, the fine vessels of the leaf during its growth and extension, and thus occasion the irregular contractions which constitute this disease: and this conclusion, which I drew many years ago, is perfectly consistent with the opinions I have subsequently entertained respecting the formation of leaves. I therefore suffered a quantity of potatoes, the produce almost wholly of diseased plants, to

to remain in the heap, where they had been preserved during winter, till each tuber had emitted shoots of three or four inches long. These were then carefully detached, with their fibrous roots, from the tubers, and were committed to the soil; where having little to subsist upon except water, I concluded the cause of the disease, if it were the too great thickness of the sap, would be effectually removed; and I had the satisfaction to observe, that not a single curled leaf was produced; though more than nine-tenths of the plants, which the same identical tubers subsequently produced, were much diseased.

In the spring of 1808 Sir John Sinclair informed me that a gardener in Scotland, Mr. Crozer, had discovered a method of preventing the curl by taking up the tubers before they are nearly full grown, and consequently before they became farinaceous. Mr. Crozer, therefore, and myself appear to have arrived at the same point by very different routes; for by taking his potatoes whilst immature from the parent stems, he probably retained the sap nearly in the state to which my mode of culture reduced it. I therefore conclude, that the opinions I first formed are well founded; and that the disease may be always removed by the means I employed, and its return prevented by those adopted by Mr. Crozer.

I sent to the Board of Agriculture the substance of the preceding remarks on the origin of the curl in the year 1808, but I do not know whether that account has been published or not.

Agricultural Hints.

By Sir JOHN SINCLAIR, Bart. President of the Board of Agriculture.

From the COMMUNICATIONS to the BOARD of AGRICULTURE.

On Drilling.

THE intelligent farmers near Holkham, as well as their respectable landlord Mr. Coke, all prefer drilling. Mr. Reeve commenced drilling fifteen years ago, and now drills all his crops of grain, wheat, barley, and oats. He sows three bushels of wheat and barley, wishing to have a full plant. The barley, having grass seeds sown with it, cannot be hoed; but the oats are hoed first with a drill-harrow, (an implement that ought to be universally used where drilling is practised); it should be then once horse-hoed, and afterwards weeded by the hand. Mr. Blomefield (Warham) began drilling about twelve years ago, and greatly prefers the drill to the broad-cast system for all grain crops. He tried the experiment on a large scale, for three successive years, with barley, oats, and pease; and he found the drill so superior, that he has never sown any broad-cast since. The produce was greater; and the quality better. There was no saving in point of quantity of seed worth mentioning. Drilling barley is peculiar expedient, and the seed may be put near the surface, (which is highly desirable, making the crop come up more regular,) and the clover sown on land when drilled has more air than when the crops are sown broad-cast.

On cultivating Wheat on small Ridges instead of Drilling.

Mr. Money Hill is of opinion, that when land that has been fallowed cannot be drilled before the 20th of October, it is better to plough in the wheat on four-feet ridges. On wet soils this system is advisable, because it keeps the seed dry; and in thin soils, because it increases the staple; for by this system the soil of five feet is put on four; and, from many years experience, Mr. Hill is convinced that the produce is as great as if the whole land had been under crop *.

Scarifying.

An intelligent farmer in Norfolk observed, that it is a bad practice to depend too much on scarifying; and he considers good ploughing necessary for the proper nourishment even of barley crops. Many farmers, however, in Suffolk, and in other districts in general, raise abundant crops of spring corn, and of barley in particular, without spring ploughing.

* The furrows should be moulded early in June by a double-breasted plough, which not only takes up all the weeds then growing, but also the few straggling stems of wheat which never come to maturity, but serve only materially to injure the sample.

On

On a new Variety of Pear.

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.*

From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

HAD the pear been recently introduced into England from a climate similar to that of the South of France, in which it had been found to ripen in the months of August and September, and to become fit for the dessert in the four succeeding months, it might have been inferred, with little apparent danger of error, that the same fruit would ripen here in October, and be fit for our tables during winter; provided its blossoms proved sufficiently hardy to set in our climate. But had many varieties of this fruit been proved by subsequent experience to be capable of acquiring maturity before the conclusion of our summer, and in the early part of the autumn, without the aid of a wall, scarcely any doubts could have been entertained of the facility of obtaining numerous varieties, which would ripen well on standard trees to supply our tables during winter: for it would be very extraordinary if the whole of our summer, and of our long, and generally warm autumn, would not effect that, which a part of our summer alone had been proved to be capable of effecting; nevertheless, though varieties of the pear abound, which bear and ripen well in the early part of the autumn, we possess scarcely any good winter pears which do not require an East or West wall in the warmer parts of England, and a South wall in the colder parts. This can arise only from the want

 of

of varieties, and I venture most confidently to predict, that (if proper experiments be made to form such varieties) winter pears, of equal merits with those which now grow on our best walls, will be obtained in the utmost abundance from standard trees; and that such pears may be sold, with sufficient profit to the grower, on as low terms as apples are now sold during winter: for I have had several opportunities of observing that the fruit of seedling pear trees generally bears a considerable resemblance to that of their parent trees, and the experiments I have made on other species of fruits induce me to believe that a good copy of almost any varieties may be obtained; and as I have more than once succeeded in combining the hardiness and vigour of the yellow Siberian crab with the richness of the golden pippin, I do not doubt of the practicability of combining the hardiness of the swan's egg pear with all the valuable qualities of the Colmar, or Bezi de Chaumontel; and I consider the climate of England as peculiarly well calculated for the necessary experiments.*

I am disposed to annex some degree of importance to the production of abundant crops of fruit, to supply our markets, at a moderate price during the winter and spring; for it has been often observed, that great manufacturing towns have generally been more healthy in seasons when fruits have abounded than in others; and the same palate which is accustomed to, and pleased with sweet fruits, is rarely found to be pleased with spirits, or strong fermented liquors: therefore, as feeble causes, which are constantly operating, ultimately produce very extensive effects on the habits of mankind, I am

* See Hort. Trans. vol. I. p. 30.

am inclined to hope, and to believe, that markets abundantly supplied at all seasons with fruits, would have a tendency to operate favourably both on the physical and moral health of our people.

Under these considerations I have amused myself with attempts to form new varieties of winter pears; and though my experiments are yet in their infancy, and I have seen the result of one only, and that under very unfavourable circumstances, I am induced to state the progress that I have made to the Horticultural Society, in the hope that others will join me in the same pursuit.

In the spring of the year 1797 I extracted the stamina from the blossoms of a young and vigorous tree of the autumn bergamot pear, which grew in a very rich soil, and I introduced at the proper subsequent period the pollen of the St. Germain pear, and from this experiment I obtained several fruits, with ripe seeds: I, however, succeeded in raising only two plants; one of these was feeble and dwarfish in its growth, as well as wild and thorny in its appearance, and I did not think it worth preserving. The other presented a much more favourable character, and I fancied that I could discover in it some traces of the features of its male parent. This plant afforded blossoms in the spring of 1808, but I had very unfortunately removed it from the seed-bed, when it was fourteen feet high, in the preceding winter, and as it had never been previously transplanted it had retained but very few roots. Two of the blossoms, nevertheless, afforded fruit; which began to grow with rapidity as soon as the tree had emitted new roots, but this was not till late in the summer, and on the eighth of October the fruit was blown from the tree by a violent storm.

storm. The two pears were then very nearly of the same weight and size, each being somewhat more than eight inches in circumference, and in form almost perfectly spherical. Though bruised by their fall the pears remained sound till the beginning of December, when they became sweet and melting, though not at all highly flavoured: their flavour was, however, better than I expected, for they were blown from the tree long before they would have ceased to grow larger, if the state of the weather would have permitted; and the autumn of 1808 was so excessively wet that some St. Germain pears, which grew on the South wall in the same garden, were wholly without richness of flavour.

The new pear very much resembled the St. Germain in the form of the eye and stalk; and the almost perfectly spherical shape is that which might have been anticipated from the forms of its parents. It will probably acquire a very large size under favourable circumstances; but removing from my late residence at Elton, I have been under the necessity of again transplanting the tree, and therefore I cannot expect to see its fruit in any degree of perfection till the year 1811. I have subsequently attempted to form other new varieties by introducing the pollen of the Beurrée, the crassane and St. Germain pears into the prepared blossoms of the autumn bergamot, the swans' egg, and Aston town pears; but I have not yet seen the result of the experiments. The leaves and habits of some of the young plants afford, however, very favourable indications of the future produce.

In the preceding experiments I have always chosen to propagate from the *seeds* of such varieties as are sufficiently

ciently hardy to bear and ripen their fruit, even in unfavourable seasons and situations, without the protection of a wall; because, in many experiments I have made with the view of ascertaining the comparative influence of the male and female parents on their offspring, I have observed in fruits, with few exceptions, a strong prevalence of the constitution and habits of the female parent; and, consistently with this position, the new pear I have described grew very freely in an unfavourable season, and in a climate in which the St. Germain pear, when its blossoms do not perish in the spring, will not grow at all without the protection and reflected heat of a wall. I would therefore recommend every person who is disposed to engage in the same pursuit, to employ the pollen only of such pears as the St. Germain, the D'Auche, the Virgoleuse, the Bezi, the Chaumontel, the Colmar, or Bergamotte de Pasques, and the seeds of the more hardy autumnal and winter kinds.

I would also recommend the trees from which the seeds are to be taken to be trained to a West wall in the warmer parts of England, and to a South wall in the colder, so that the fruit may attain a perfect, though late, maturity. Every necessary precaution must of course be taken to prevent the introduction of the pollen of any other variety, than that from which it is wished to propagate, into the prepared blossoms.

I shall take this opportunity of pointing out to the Horticultural Society the merits of a new variety of plum, (Goe's Golden Drop,) as a fruit for the dessert during winter, with which the public are not sufficiently well acquainted. Having suspended by their stalks, in a dry room, some fruit of this variety which had ripened

on

[redacted]

[illegible] in the year 1796. It remained perfectly sound till the middle of December, when it was thought by my guests and myself to be [illegible] either in richness or flavour, to the green gage or any other plum. I am informed by Mr. Whitney, of Old Brompton, from whom I received it, that it bears well on standard trees.

Observations on the Art of Glass-making, explaining some of the Phenomena that occur in the Process, with Directions for applying them to effect new Products.

By M. GUYTON MORVEAU.

(Concluded from Page 314.)

Fourth Observation.—Of the Alteration that Glass undergoes from the Action of a strong Heat long continued.

THE interesting memoir of M. d'Arigues on the *devitrification of glass*, in the Annales de Chimie, vol. L. has brought back our opinions to the true cause of this phenomenon, too long regarded as the product of a cementation, according to the processes of Reaumur. Some facts that I long ago collected may be useful to illustrate the explanation he has given.

In 1782, M. Ciffé, a maker of porcelain at Luneville, sent me several specimens of glass of different qualities, rendered opaque by the action of a long continued heat, without its having been surrounded by a mixture of gypsum and sand in the manner of Reaumur. The five pieces that I now exhibit to the class, are a part of these specimens, and which still retain the tickets he attached to them.

No.

No. 1, is a fragment of common window-glass, 13 centimetres by 10, (it was longer when I received it, but I reduced its dimensions, in order to make experiments upon some of the pieces), which having been exposed to a great porcelain fire without any cement, is become absolutely opake and very white without altering its form, and has also acquired much greater hardness and solidity.

No. 2, a piece of the same glass, exposed in the same furnace and touched by the flame, is equally opake and of a fine white in the fracture: the surface only is of a yellowish cast.

No. 3, a fragment of bottle glass exposed to the fire in charcoal dust, has acquired a similar opacity; the interior is a fine white, and the whole surface has a uniform and brilliant coating of a black brown.

No. 4, is a fragment of a bottle, submitted to the heat of a porcelain stove, surrounded by pulverised soot, which has acquired a coating of a deep bistre on the surface, and the interior is completely devitrified, and equally white as the others.

No. 5, is the bottom of a bottle, that was exposed to the most violent fire without being surrounded by any substance whatever. This is white and opake throughout.

At the time that these experiments were made by M. Ciffle, and even some years before, Mr. James Keir had already declared that glass might be rendered opake by a prolonged heat, without employing any cement; that in this state it had greater density and was less susceptible of breaking in passing suddenly from heat to cold and *vice versâ*. This last property has also been confirmed by the experiments of M. Ciffle, insomuch that he

[redacted]

he has no hesitation in considering the glass thus altered, as the most proper material to give to chemistry vessels at once of a refractory quality, and not subject to crack.

M Keir, after describing these phenomena, attributes the cause to the *crystallization* of the vitreous matter; an opinion naturally formed from the appearance of the fracture of the glass, thus rendered opake, which, instead of being scaly like that of transparent glass, presents, if not facets at least very decided parallel streaks.

The observations of M. d'Artigues strongly support this conclusion. I myself possess a piece of glass found five years since, in the bottom of a crucible in the manufactory of St. Gobin, which furnishes a demonstration of it, for even by the naked eye may be distinguished prisms shooting from the devitrified crust which forms the surface, and the thickness of which is at least from 2 to 3 millimetres.

Is it true, however, that all these changes are but the effect of a crystallization; and can we admit with M. d'Artigues *that it produces a precipitation in the whole mass; each of the components obeying the laws of affinity at the same time* *? Before I consider these questions, I shall add some facts resulting from experiments made on this subject by M. d'Arcet, which naturally belong to this discussion.

Of the ten specimens that he has remitted to me, No. 1 is a piece of bottle glass which has been exposed for 3 days to a heat of 50 degrees of Wedgwood in Reaumur's cement.

The devitrification is complete; it has taken internally

* See Repertory, vol. VI. Second Series, p. 441.

a rosy

a rosy tint; the fracture presents at the centre radiated streaks; it gives no signs of electricity by friction; it cuts rock crystal, or rather it cannot be cut by that substance; corundam leaves on it a trace scarcely distinguishable with a magnifier.

No. 2, exposed to the same fire, in the same cement, and during the same time, has scarcely acquired an earthy crust, and may be scratched by rock crystal; the interior remains a greenish transparent glass, forming a kind of geode by the retraction of the substance that adheres to the crust: this glass contained oxyd of lead.

No. 3, are two artificial stones engraved in relief; which were formed from bottle glass, moulded first in a cupelling furnace upon an impression taken with tripoli, and then devitrified at a heat of 51 degrees of Wedgwood. They are not electrical by friction, even on the polished face; their specific weight is 2.801; corundam leaves scarcely a visible trace upon it. This hardness, and the neatness of the impressions taken from them, have caused the products of these trials to be used in the ornamental arts; not only for stones engraved in relief but also for cameos, of which they have arrived at the art of colouring variously both the ground and the reliefs, by laying them on beds of different composition in order to imitate the onyx; and which have received afterwards from the devitrification the hardness which forms the principal character of precious stones. I shall not speak further of this new art, which it is easy to foresee will be improved in the process, and multiplied in the applications.

No. 4, is a portion of a balloon of the same glass, cut to be used as a capsule, and afterwards devitrified in the

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cement of Reaumur at 50° of the pyrometer. The fragments that are attached to it, coming from a similar capsule, shew the fracture to be striated; corundum hardly makes a visible mark upon it; and it is not sensibly electrical by friction. Finally, these pieces may be made red-hot upon the coals, and thrown immediately into water without losing any of their solidity; I have put them in sulphuric acid in the strongest fire, and they have come out without the least alteration or loss of weight.

No. 5, is remarkable for the differences it presents. It has, besides the vitreous fracture, a marked translucency at the edges; it becomes electric by friction; it is scratched by silex. Thus it differs in nothing from bottle glass except by the enamelled or grey porcellanous appearence that it has acquired in losing its transparency. But these differences are explained by those processes employed in this trial, the object of which was to discover what could be obtained by slow refrigeration alone. It is evident that the heat has not been carried to a sufficient height, or that it has not been continued for the necessary time in order to complete the devitrification.

Nos. 6, 7, and 9, are the results of trials of the devitrification of fragments of church-windows, coloured red with oxyd of gold, and blue with oxyd of cobalt. The two first in losing their transparency have acquired a purple tint; but that in which lead entered into the composition, had little consistence, was internally bubbled and spongy; whilst in the second the devitrification had followed the usual and regular steps on the two surfaces, the middle only still retaining its vitreous texture, which would have disappeared by a continuance of the

the fire. This vitreous part gives some signs of electricity by friction, and rock crystal cuts it.

The fragment coloured by cobalt exhibits, by its appearance being still a little vitreous in the fracture, that the devitrification is but little advanced; however, it has lost all its transparency; the blue colour, although melted in the mass, is much more intense at the surface. It is still feebly electric, and its hardness is such, that corundum scarcely makes any sensible impression upon it.

No. 8, is to be remarked as a new proof, that the devitrification always commences at the surfaces, and advances by degrees to the centre, when the heat is continued long enough. This piece resembles a small geode, of which the crust being entirely devitrified, encloses a remainder of matter in the state of perfect glass. We shall see that these accidents are equally produced in the devitrification, and by the fire of volcanos.

No. 10, is the last, and also the most interesting result. It is an experiment on artificial stones, engraved in relief, not moulded as before, whilst in the state of glass, in order to pass afterwards through the devitrification; but the matter had been devitrified before it was placed on the mould to receive the impression. The fusion has yielded a very homogeneous mass, of an obscure grey, which has but imperfectly taken the relief upon which it was cast, but the fracture is absolutely vitreous, and the translucency of the edges clearly announce the return to the state of glass, such as it might be in the proportions of its actual composition.

From these characters I suspected that a corresponding change must have taken place in the specific gravities of the mass, which I found, when thus reduced again

again to the vitreous state, to be only 2.625, whilst that of the same glass, completely devitrified, rose constantly from 2.770 to 2.801.

M. d'Artigues has justly observed, that the devitrified glass becomes a better conductor of caloric and of electricity; we have seen, accordingly, that several fragments of glass in this state give no sign of electricity by friction. If it were possible to doubt that this property appertains more essentially to the nature of the constituent parts than to the mode of their arrangement, we should be convinced of the fact by the result of the experiment in which the devitrified glass, restored to its original state by re-melting without addition, and having reassumed its original density, its fracture and all the vitreous character, (except the transparency which only shews itself on the borders,) has not shewn a greater tendency than before to electricity by friction.

All the experiments hitherto mentioned shew that devitrification always begins at the surface, whence it becomes of importance to examine the circumstances which appear to contradict the general principle.

Are there really examples of a devitrification effected internally or between two unaltered laminæ of glass? M. d'Arcet sent to me a plate from the glass manufactory at Prémontré, which appeared at first sight to demonstrate the possibility. The part completely devitrified forms a very white layer, absolutely opake, from five to six millimetres thick, between two laminæ of green glass a little thicker, which preserves its transparency, and presents a very decided vitreous fracture, in opposition to the striated fracture of the devitrified part.

But on examining this mass with care, it was soon perceived that it had been disturbed in cooling, and that a portion

a portion of the still fluid glass lying below the opake and refractory crust, had been carried above it by the motion imparted to the crucible when taken out of the furnace. The appearance of another piece of the same glass, in which the two laminæ appeared in their natural order, appears to me to leave no doubt of the accuracy of this interpretation.

Fifth Observation. — The Devitrification of Glass by the Fire of Volcanos.

It is known that the system formed by the celebrated Dolomieu declares that the fire of volcanos does not act in the same manner as the fire of our furnaces; that although it produces prodigious effects, it has not a very great activity; that the fluidity it produces is not owing to a complete vitrification of the substances contained; indeed, that even the most fusible substances, when inclosed in the bodies of rocks, may run into inflamed torrents without undergoing any sensible alteration.

He believed that he had found a proof of this theory in the state to which pieces of glass were reduced when the terrible eruption in 1794 covered the Torre del Greco. This glass, of which the form could still be discovered, had become of an opake white, and this alteration sometimes extended throughout the whole thickness, sometimes it left the glass still entire, with its colour and transparency between the two opake crusts. Dolomieu exhibited to the Class several of these specimens found in the remains of the Torre. He had the politeness to send me a few pieces; some of which had the marks of volcanic scoriæ adhering to them *. I pro-

* M. Breislak, in his Voyage de la Campanie, tom. I. p. 280, mentions a piece of window-glass, bent in various directions, of which

mised him in exchange several fragments in which he would discover the same alterations and the same progress towards devitrification that were found in an extinguished furnace, where, as it often happens, the broken glass was raised against the sides* to remain there until the work ceased, or until the quantity obliged them to suspend it in order to empty the furnace.

Dolomieu having seen them in my collection with Professor Pfaff, of Kiel, who was then at Paris, frankly owned that he had not any objection to make against the identity of the effects of the fire of the glass-house and of the fire that had acted on the pieces found in the remains of the Torre: he chose some of the pieces in order to place them in his cabinet.

The fact which authorises us to assimilate in its effects to an equal intensity the fire of volcanos and those of our furnaces, is supported by the experiments communicated to me by M. d'Arcet, and which are equally interesting from the applications which they furnish, and the hints that may be drawn from them for explaining the formation of basalt.

It is known that the basalt melts at a heat of about sixty degrees of Wedgwood's pyrometer; and, as Sir James Hall has justly remarked, the product of this fusion is a glass, which possesses all the characters and properties of volcanic glass. I have myself obtained, in a considerable mass, basaltic prisms from the extinct volcano at Drevin, which, after the operation, could no longer be distin-

* which the surfaces were changed into the porcelain of Reaumur, whilst the interior preserved the state and appearance of glass. Thomson had already described, in his catalogue of substances found in the lava of 1794, some fragments of glass thus modified, to which he gave the name of *glasstein*; that is, glass-stone.

guished

guished from the glass produced by the fusion of obsidian, or vitreous lava.

On the same volcano glass M. d'Arcet tried the process of devitrification; he submitted to it some pieces of from fifteen to sixteen cubic centimetres, from 2.775 to 2.784 of specific gravity; and he observed that they devitrified completely at the fire of the cupell furnace; that if the heat had been carried only to fifty degrees of Wedgwood, a portion that at first was devitrified, would have returned to the state of glass.

I need not remark the conformity of these results with those that Hall obtained by the slow cooling of basalt, which he had at first converted into glass, and on which he principally founds his opinion, that basalt has been originally in a state of vitreous fusion.

The volcanic glass, thus brought back to the state of lethoid lava very compact, and of a very fine grain, has induced M. d'Arcet to cause it to be polished, in order to serve for touch-stones, and the trials he has made with them leave no doubt that they may be substituted for the natural stones of the best quality, which become very rare.

Examination of what actually constitutes the Difference between transparent and devitrified Glass.

It now remains to be examined, whether the facts that I have exposed can be explained by simple crystallisation, or rather, whether they can be reconciled with the known effects of this passage of bodies to a state of regular concretion, and with the hypothesis of a simultaneous precipitation of some of their fixed elements.

I shall first remark, that if a crystallisation and precipitation had both taken place at the same time, the

opake mass thence resulting would not be crystallised glass, but the product of its decomposition.

In the second place, if there had been actually a separation of some of the ingredients of the glass, they would at least offer, in some points, the appearance of the colours, the degree of hardness, and the other characters that belong to them; but of these there were no signs.

Lastly, I shall remark, that in this supposition, the state of combination having ceased, the uncombined parts would become immediately subject to the chemical action of their solvents; but it is invariably the case, that devitrified glass is never in any degree acted on, even by the most powerful acids, aided by the heat of ebullition. It must therefore be acknowledged, that the union does subsist, and even most intimately, since this it is which constitutes bodies the most homogeneous, the most solid, the hardest, and those most capable of resisting fusion and dissolution.

According to M. d'Artigues, the devitrified glass becomes fusible when, by reducing it to a powder, the substances that were separated are again put into contact, and thus reciprocally fuse each other. I wished to decide by experiment, whether this fusion could restore the glass, with its transparency and other characteristical properties. I took a fragment from No. 1 of M. Ciflé's specimens, which was a square of window-glass, devitrified without any cement, that remained white, completely opake, and of an extraordinary solidity, notwithstanding its thinness. Having reduced it to a powder, I put seven grammes of it into a covered platina crucible, and I raised the fire to 160° of Wedgwood. I obtained a mass pretty well melted, but white,

white, approaching feebly to a greenish cast, having hardly an appearance of translucency at the edges, very uniform at the surface, and filled below it with little cavities, produced by the bubbling. It had lost in weight fifty-nine milligrammes, or a little more than $\frac{8}{1000}$ths of its weight. It became interesting to examine the changes that the remelting would occasion in plate-glass, in which the reciprocal saturation of the silex and fluxes is commonly more exact, and especially if there should also be a diminution of weight. I put into a platina crucible sixty-two grammes of glass of St. Gobin, pulverised, and I kept it for three hours and a half at a heat of 48° of Wedgwood. I obtained a mass perfectly melted, with the surface woolly, (to use the expression of the glass-makers,) which announced a feeble commencement of devitrification *, which had a yellowish aspect, and a little more hardness than the interior, alterations which M. d'Artigues had already observed in such glass as, in consequence of a more simple composition and a more perfect combination, gives a much greater resistance to the continued action of heat. The great number of bubbles that were formed in the lower part prevented me from determining the specific weight with accuracy; but there was a diminution of weight of two decigrammes, or a little more than three thousandths, without any circumstance in the operation that could raise a sus-

* This surface, viewed with a magnifier, presents an immense quantity of small fissures, which by the crossings form sections of unequal sided prisms. By causing the light to pass through the two opposite fractures on their sides, we may perceive beneath the upper crust the rudiments of crystallisation, which also indicate the first effects of the devitrification.

picion of its proceeding from any other cause than the loss of a similar quantity of matter *.

To these already powerful reasons for rejecting the hypothesis, either of a simple modification or of the precipitation of the component parts, let us add the two principal characters that are produced by devitrification, the augmentation of the hardness and the diminution of the bulk.

Among the number of products of devitrification that I have shewn to the Class, there are many, as I have before remarked, that cannot be cut by rock crystal; there are others on which scratched corundum leaves a mark, hardly visible with a magnifier; and M. Cliffé's No. 3 scratches rock-crystal as the emerald would.

The *density* that the glass acquires in this operation is still more striking, although it be like the hardness, only the effect of a more powerful force of aggregation. All the pieces, of which I have been able to compare the specific weight, have given a difference at most of from sixteen to eighteen-thousandths. M. d'Arcet had two cubes of glass from the glass-house at Garre, on purpose to ascertain the bulk before and after the devitrification, by means of the scale of Wedgwood's pyrometer. One advanced seventeen degrees, and the other eleven, which gives for the first the proportion of 1030 to 909, and for the second of 1000 to 952. The glass being taken from the

* M. d'Arcet has sometimes found the weight of cubes of glass that he had submitted to devitrification augmented 5 milligrammes on 2 grammes; but his experiment was made in a cement. It would have been the same, infallibly, with M. Cliffés pieces, Nos. 3 and 4, which, as we have seen, came out with coatings. Nothing can be concluded against the two experiments I have related, which were made without cements in platina crucibles.

the same mass, and consequently of the same quality, the difference in the two results could only be attributed to a portion of the cement, more or less considerable, remaining attached to the surface of the cubes, which nevertheless has always been far from equivalent to the reduction of the primitive quantity. This is also proved by the colour which the devitrified pieces acquire on the surface in the cement of Reaumur; a colour which often penetrates them to some depth, and which can only proceed from the portions of metallic oxyds contained in the sulphate of lime employed.

I think, therefore, that it may be concluded, that the characters and properties that distinguish transparent and devitrified glass are not solely the product of the crystallisation, either of the same integrant molecules, or of some of its elements, which would form a new combination, the others being separated from them by precipitation; but that there is really a change of the proportion of the composition by the volatilisation of some portion of the matter.

At a period when the progress of chemical analysis is daily shewing to us that less than a thousandth part of a substance added or abstracted in a composition produces very material changes in its properties, we cannot admit of the interpretation of so many characters and properties so striking by a simple mode of structure.

List

List of Patents for Inventions, &c.

(Continued from Page 320.)

WILLIAM STRACHAN, of Pool Cottage, in the county of Chester, Chemist; for a method of making salt. Dated October 1, 1811.

The following were omitted, by accident, to be inserted in our Number for November last.

MARC ISAMBARD BRUNEL, of Chelsea, in the county of Middlesex, Gentleman; for an apparatus for giving motion to machinery; part of which is also applicable to hydraulic and pneumatic purposes. Communicated to him by a person residing abroad. Dated October 1, 1810.

BENJAMIN MILNE, of Bridlington, in the county of York, Collector of Customs; for an improved bell and gun alarm. Dated October 1, 1810.

JOSEPH C. DYER, of Boston, state of Massachusetts, one of the United States, now residing in London, Merchant; for certain improvements in the construction and method of using plates and presses, and for combining various species of work in the same plate, for the kind of printing usually called copper plate printing, designed for the objects of detecting counterfeits, for multiplying impressions, and saving labour. Communicated to him by a person residing abroad. Dated October 1, 1810.

GEORGE MILLER, of Panton-street, near the Haymarket, in the parish of St. Martin in the fields, in the county of Middlesex, Musical Instrument-maker; for a method

method of making wind instruments, commonly called military fifes, of substances never before used for that purposes. Dated October 1, 1810.

JOHN TORVILL RUFF, of Goswell-street, in the county of Middlesex, JOHN WEBB, of Hoxton, in the said county, and JOHN FRETTON, of the city of London, Card manufacturers; for an apparatus to machines for making fillett, sheet, and hard cards, such as are used for carding wool, cotton, flax, silk, and all substances capable of being carded. Dated October 8, 1810.

EBENEZER PARKER, of Highfield, in the parish of Sheffield, in the county of York, Silver-plater, and FRANCIS OLNLEY, of Sheffield aforesaid, Surgeons' Instrument manufacturer; for a method or plan of making an adjusting bedstead, on a double frame, with a fourfould method for the relief of sick, lame, infirm, and aged persons. Dated October 8, 1810.

JOHN HEYLEDINE, of Bridgnorth, in the county of Salop, Engineer; for manifest improvements in the construction of a plough for the cultivation of land. Dated October 8, 1810.

GEORGE HODSON, of the city of Edinburgh, North Britain, Ash-manufacturer; for a method of separating alkaline salt from the acid as it exists in the following substances; *viz.* kelp, black ashes, soapers' salts, spent leys, sosa natrose, rock salt, common salt, brine, sea water, caput mortuum of aquafortis, caput mortuum of oil of vitriol, and caput mortuum of salt used by bleachers, being on a principle entirely new. Dated October 8, 1810.

CHARLES FRANCIS, of Phœnix Wharf, Nine Elms, in the parish of Battersea and county of Surrey, Temper Lime-burner, and WILLIAM WATERS, of Princes-street, in

in the parish of St. Mary Lambeth, in the said county of Surrey, Potter; for a method of joining pipes. Dated October 8, 1810.

Henry Stubbs, of Piccadilly, in the county of Middlesex, Blind-maker; for a grand imperial aulacum, from three to eighteen or twenty feet wide, without seam, and to any length or colour, for decorating the most superb or useful room, for such as drapery, curtains, and fringes, chairs, sofas, tables, &c. or finished on one side only, for ornamental hangings, borders, and every other species of decoration. Dated October 8, 1810.

Edmund Griffith, of the city of Bristol, Esquire; for certain improvements in the manufacture of soap, for the purpose of washing with sea water, with hard water, and with other water. Dated October 8, 1810.

Richard Woodman, of Hammersmith, in the county of Middlesex, Boot and Shoe-maker; for a method of manufacturing all kinds of boots, shoes, and other articles. Dated October 8, 1810.

Edward Manley, of Uffculme, in the county of Devon, Clerk; for an apparatus for writing. Dated Oct. 8, 1810.

John Fraser, Collector of Natural History, now of Sloane-square, in the county of Middlesex; for a discovery of certain vegetables, and a way of preparing the same, so as they may be usefully applied in the manufacturing of hats and bonnets, chair bottoms, and baskets, and for other articles or purposes. Dated October 15, 1810.

John Wheatley, of Greenwich, in the county of Kent, Coach-builder; for an improved axletree for wheels of carriages, and also improved wrought or cast iron boxes, and cast iron stocks, to receive the spokes of the wheels. Dated October 15, 1810.

END OF THE NINETEENTH VOLUME.—SECOND SERIES.

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